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KEY TO AND DESCRIPTIONS OF THE THIRD INSTAR LARVAE OF SOME SPECIES OF SYRPHIDAE (DIPTERA) OCCURRING IN BRITAIN

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[Communicated by Professor O. W. Richards, F.R.S.]

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With 8 Text-figures

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I. Introduction

Metcalf (1913*a*) was the first to attempt a classification of larvae of the family Syrphidae. In America, several keys to third instar larvae were subsequently published (Metcalf, 1916; Fluke, 1929; Johannsen, 1935; Heiss, 1938), the most important being those of Johannsen to aquatic larvae and Heiss to syrphid larvae excluding aquatic forms. Vimmer (1933) gives a key to Czechoslovakian syrphid larvae and pupae. Hennig (1952) gives a key to many genera, which is followed by a fairly complete list of descriptions of known immature stages of Syrphidae. However, there is no key to species of syrphid larvae occurring in Britain. In the present account, the third (last) instar larvae of 56 of the 234 species of Syrphidae occurring in Britain are included in a key, which must be regarded as a tentative one. Of these, 15 species have not hitherto been described, and 35 are redescribed as existing accounts are incomplete, many consisting only of a note on the size and colour of the larvae.

Eggs and larvae were either taken in the field and the larvae identified by rearing them through to the adult stage, which is readily identifiable, or they were reared from eggs laid in the laboratory by identified females. Specimens were also examined from the spirit collection in the British Museum (Natural History). Where descriptions in the literature are comprehensive, these are used for completeness, as indicated in the text.

The following method for preservation of larvae was used. Once larvae had voided the gut, just before pupation, they were killed by immersion in hot but not boiling water to extend them, and then preserved in 90 per cent. alcohol. If preserved before the gut contents are completely eliminated, larvae darken and this makes many of the characters difficult to see. Measurements were made of fully extended larvae. Where possible the posterior respiratory process was examined microscopically. A description of each species of larva follows the key.

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Third instar larvae of the Syrphidae occurring in Britain can be distinguished from all other cyclorrhaphan larvae by the contiguous and fused posterior respiratory tubes that form the posterior respiratory process ; and by the presence of segmentally arranged specialised hairs that constitute the segmental ornamentation.

An American species, *Mesogramma polita* Say, is the only species known in which the posterior respiratory tubes are fully separated in the third instar (Heiss, 1938). In first and second instar syrphid larvae the tubes are generally separate, but may be partly or completely fused in saprophagous species.

The segmental ornamentation consists of short conical hairs (most aphidophagous species), strongly sclerotized spines (*Rhingia campestris*), or branched or tufted hairs (many aquatic species). The number of specialised hairs on the abdominal or body segments is not always twelve, as stated by Metcalf (1913*a*) and Heiss (1938), although this is commonly true in aphidophagous species, except on the last segment where there was a maximum of four hairs, and often two, in the species examined. For example, in *Rhingia campestris* there are up to 16 spines, according to the segment ; in *Volucella zonaria* and *V. pellucens*, 16, 18, 14, or 10 hairs ; in *Merodon equestris*, 14 or 8. The number on each segment, respectively, is constant for a species.

In the following key and descriptions the nomenclature follows that given by Parmenter (1954), which is based on Coe's interpretation of the group (1953). The descriptive terms adopted by Heiss (1938) are used. The list of published descriptions given by Hennig (1952) for each of the species in the following key has been brought up to date.

II. Key

1 Larva with internal mouth hooks ; false head absent ; posteriorly, body rounded, truncate, cuspidate or sloping postero-ventrally ; posterior respiratory process terminal or postero-dorsal, entirely sclerotized. *Larva phytophagous in bulbs, aphidophagous, or found in nests of Hymenoptera* . 2

– Larva lacking internal mouth hooks ; first four segments usually forming a false head, often marked with longitudinal furrows ; posteriorly, body tapering and ending in an entirely sclerotized respiratory process (figs. 7*D*, 8*A*) or body constricted and ending in a long telescopic respiratory process (fig. 8*L*) of two fleshy segments and a third distal sclerotized segment. *Larva filter-feeding, aquatic, semi-aquatic or phytophagous in bulbs* . . . 44

2 Body oval in outline from above and hemispherical in cross-section ; segmentation not apparent ; segmental ornamentation absent ; dorsal surface patterned with ridges or papillae ; a fringe of spinules surrounding ventral sole (figs. 1*G*, 1*J*). 3

– If body oval in outline from above, not hemispherical in cross-section ; segmentation indicated by transverse wrinkles and segmental ornamentation (figs. 3*D*, 3*G*, 4*A*, 5*D*, 6*D*) ; body lacking a fringe of spinules surrounding ventral sole 5

3 Larva white . . . . . (1) **Microdon mutabilis** (L.)

– Larva brown 4

4 Numerous spiracular openings situated on a large oval prominence on each spiracular plate (fig. 1*H*) . . . . . (2) **Microdon eggeri** Mik

– Numerous spiracular openings situated on an area surrounded by lobular patterns but not raised above the level of the remainder of spiracular plates (fig. 1*K*) . . . . . (3) **Microdon devius** (L.)

5 Prolegs with claws present (figs. 1*A*, 1*B*) 6

– Prolegs absent, or if present, lacking claws 9

6 Fleshy projections absent ; posterior respiratory process terminal (fig. 1*D*) ; prolegs with one row of claws . . . . . (4) **Volucella inanis** (L.)

– Fleshy projections present (fig. 1*E*) ; posterior respiratory process postero-dorsal ; prolegs with two rows of claws 7

7 A circlet of only six fleshy projections present posteriorly (5) **Volucella bombylans** (L.)
– Fleshy projections present laterally and posteriorly 8
8 Larva over 1·5 cm. in length . . . . . (6) **Volucella zonaria** (Poda)
– Larva less than 1·5 cm. in length . . . . . (7) **Volucella pellucens** (L.)
9 Body cylindrical, rounded anteriorly and posteriorly; a small tubercle present on either side of posterior respiratory process; external mouth hooks enlarged, toothed, fused along the median line, and directed ventrally (fig. 1*F*); larva with integumental vestiture of fine colourless spinules . . . . . (8) **Merodon equestris** (Fabricius)
– Body cylindrical, subcylindrical or flattened, attenuated anteriorly, rounded or cuspidate posteriorly; external mouth hooks (fig. 3*B*) not visible to naked eye and separate; integumental vestiture present or absent . . 10
10 Body cylindrical, tapering anteriorly, rounded or truncate posteriorly; uniform white or pale cream in colour 11
— Body oval in cross-section or markedly dorsoventrally flattened; uniformly pale yellow, green or black, or with colour patterns due to underlying fat body (fig. 5*B*) or internal organs; spiracles straight or sinuous; median groove present between spiracular plates (figs. 2*A*, 2*B*, 2*C*, 3*A*, 4*B*, 4*C*, 4*D*) 12
11 Spiracles convoluted; spiracular plates not separated by a median groove (9) **Xanthogramma pedissequum** (Harris)
— Spiracles straight; spiracular plates separated by a distinct median groove (fig. 1*C*) . . . . . (10) **Chrysotoxum verralli** Collin
12 Integumental vestiture when present differentiated into segmentally arranged aggregates of spinules differing in form (except in *Syrphus latilunulatus*) from the remainder of integumental vestiture 13
— Integumental vestiture of uniform length and uniformly distributed except sometimes on segment 12 20
13 Spiracles short, elongate-oval, not extending over sides of posterior respiratory process when viewed from above (figs. 2*A*, 2*B*, 2*C*) 14
— Spiracles narrow, elongate, slit-like, extending over sides of posterior respiratory process when viewed from above (figs. 3*A*, 5*A*) 19
14 Larva with dorsal pattern of chevrons due to adipose tissue 15
— Larva with two broad dorsal stripes, or symmetrical arrangement of adipose tissue absent 18
15 Larva green with purple or pink chevrons; spiracles I, II and III equidistant; interspiracular ornamentation of single setae (11) **Platycheirus scutatus** (Meigen)
— Larva light brown; spiracles equidistant on each spiracular plate or spiracles II nearer to III than to I; interspiracular ornamentation of single, or paired setae 16
16 Spiracles II nearer to III than to I; interspiracular ornamentation of paired setae; median groove with a smooth surface (fig. 2*A*) (12) **Platycheirus albimanus** (Fabricius)
— Spiracles equidistant or II nearer to III than to I; interspiracular ornamentation of single setae; median groove rugose or with longitudinal grooves 17
17 Spiracles II nearer to III; interspiracular setae as long as width of a spiracle (fig. 2*B*) . . . . . (13) **Platycheirus manicatus** (Meigen)
— Spiracles equidistant on each spiracular plate; interspiracular setae about half as long as the width of a spiracle (fig. 2*C*) (14) **Platycheirus clypeatus** (Meigen)
18 Larva buff pink with two dorsal cream stripes; spiracles three times as long as wide . . . . . (15) **Baccha elongata** (Fabricius)
— Larva bright green, shining; spiracles twice as long as wide (16) **Melanostoma scalare** (Fabricius)

19 Larva green with a broad white or cream stripe on either side of heart line; posterior respiratory process one and a half times as long as broad (17) **Sphaerophoria scripta** (L.)

— Larva coloured otherwise; posterior respiratory process longer than broad, broader than long, or as long as broad 23

20 Posterior respiratory process longer than broad, not recessed in a triangular depression . . . . . (18) **Pipiza noctiluca** (L.)

Posterior respiratory process shorter than broad, recessed in a triangular depression 21

21 Body dorsoventrally flattened; three thorn-like appendages present on either side of mouth; interspiracular ornamentation of large lamellae giving spiracular plates a frilled appearance . . (19) **Didea fasciata** Macquart

— Body subcylindrical; thorn-like appendages absent near mouth; interspiracular ornamentation of inconspicuous nodules 22

22 Larva green with a white, cream or pink median stripe and a fine dorsolateral line on either side of the body; spiracles II and III parallel (fig. 4*B*) . . . . . (20) **Scaeva pyrastri** (L.)

— Larva greyish-brown, flecked with cream and orange, or larva green with a white or cream stripe broken by segmentally arranged groups of orange to brown aggregations of adipose tissue, sometimes a broad brown band underlying median white or cream stripe; spiracles II and III markedly divergent (fig. 4*C*) . . . . . (21) **Scaeva selenitica** (Meigen)

23 Dorsal segmental spines on segments 6–11 at least one-third length of other segmental spines on the same segments, respectively (fig. 4*A*) . . . 24

— Segmental spines subequal on each segment, respectively; if segmental spines not subequal, body form as in fig. 4*F* 25

24 Dorsal segmental spines on segments 3 and 6–11 one-sixth as long as other segmental spines on these segments; all segmental spines directed posteriorly . . . . . (22) **Paragus bicolor** (Fabricius)

— Dorsal segmental spines on segments 6–11 one-third as long as other segmental spines on these segments; segmental spines directed posteriorly on last three abdominal segments . . . . . (23) **Paragus tibialis** (Fallén)

25 Posterior respiratory process terminal (fig. 3*D*) . (24) **Pipizella varipes** (Meigen)

— Posterior respiratory process postero-dorsal 26

26 Larva brown with yellow-orange chevrons . . . (25) **Leucozona lucorum** (L.)

— Larva coloured otherwise 27

27 Integumental vestiture present 28

— Integumental vestiture absent 32

28 Lateral projections and two long curved posterior fleshy projections present (fig. 4*F*) 29

— Lateral fleshy projections absent, body serrate in outline (fig. 3*G*) . . . 30

29 Dorsal spurs as high as length of a spiracle; interspiracular ornamentation of longitudinal ridges parallel to spiracles (fig. 5*C*) (26) **Syrphus albostriatus** (Fallén)

— Dorsal spurs about half as high as length of a spiracle; interspiracular ornamentation of round nodules (fig. 5*A*) . . . (27) **Syrphus tricinctus** (Fallén)

30 Spiracles II and III parallel (fig. 4*E*) . . . (28) **Syrphus corollae** (Fabricius)

— Spiracles II and III divergent (fig. 4*D*) 31

31 Apices of dorsal spurs as high as spiracles I when posterior respiratory process viewed from behind . . . . . (29) **Syrphus luniger** Meigen

— Apices of dorsal spurs slightly higher than spiracles I (30) **Syrphus latilunulatus** Collin

32 Larva markedly dorsoventrally flattened 33

— Larva subcylindrical 37

33 Larva broadly ovate from above 34

— Larva truncate posteriorly, narrowing anteriorly 35

34 Four conical lateral prominences present on each segment when viewed from above, the first, second and third bearing segmental spines; median segmental spines also mounted on small conical prominences (besides papillae); posterior respiratory process one and a half times as long as breadth of apex . . . . . (31) **Syrphus nitidicollis** Meigen

— Lateral conical prominences not visible from above; median segmental spines not mounted on conical elevations (besides papillae); posterior respiratory process twice as long as width of base (32) **Syrphus eligans** (Harris)

35 Larva entirely black (fig. 5*D*) . . . . . (33) **Syrphus guttatus** (Fallén)

— Larva with white or pink markings 36

36 Dorsal spurs pointed, claw-like; circular plates almost circular (fig. 6*B*) (34) **Syrphus cinctus** (Fallén)

— Dorsal spurs elongate ridges; circular plates elongate longitudinally (fig. 6*C*) (35) **Syrphus triangulifer** (Zetterstedt)

37 Posterior respiratory process as long as broad; interspiracular ornamentation of 4 pairs of setae . . . . . (36) **Syrphus grossulariae** Meigen

— Posterior respiratory process longer or shorter than broad; interspiracular ornamentation consisting of ridges or nodules 38

38 Posterior respiratory process longer than broad 39

— Posterior respiratory process shorter than broad 40

39 Spiracles equidistant on each spiracular plate; dorsal spurs prominent, sharp, pointed, triangular in side view; interspiracular ornamentation of prominent ridges parallel to spiracles . (37) **Syrphus umbellatarum** (Fabricius)

— Spiracles II nearer to III than to I; dorsal spurs short ridges; interspiracular ornamentation of inconspicuous nodules (38) **Syrphus auricollis** Meigen

40 Posterior wall of posterior respiratory process much shorter than anterior wall (fig. 7*B*) . . . . . (39) **Syrphus cinctellus** (Zetterstedt)

— Anterior and posterior walls of posterior respiratory process of approximately equal length 41

41 Dorsal spurs absent; spiracles III parallel to median groove separating spiracular plates (fig. 6*E*) . . . . . (40) **Syrphus balteatus** (Degeer)

— Dorsal spurs short, pointed; spiracles III convergent posteriorly towards median groove 42

42 Interspiracular nodules close to inner ends of spiracles (fig. 7*E*) (41) **Syrphus torvus** Osten-Sacken

— Interspiracular nodules halfway along length of spiracles (fig. 7*C*) . . . 43

43 Posterior respiratory process pale yellow brown . . . (42) **Syrphus ribesii** (L.)

— Posterior respiratory process dark reddish-brown (43) **Syrphus vitripennis** Meigen

44 Body tapering posteriorly, ending in a sclerotized posterior respiratory process less than length of body when fully extended 45

— Body constricted posteriorly, then ending in a long tail-like posterior respiratory process greater than length of body when fully extended; this process of three telescopic segments, basal and middle segments fleshy, distal segment sclerotized 52

45 Posterior respiratory process ending in a pointed needle-like structure; spiracles lying longitudinally along posterior respiratory process and removed from apex (fig. 8*E*) . . . . . (44) **Chrysogaster hirtella** Loew

— Posterior respiratory process ending truncately; spiracles convoluted, lying on apical spiracular plates all on one plane (fig. 8*J*) 46

46 Segmental ornamentation heavily sclerotized, consisting of long spiked processes becoming longer and more spiked on posterior segments (fig. 8*H*) (45) **Rhingia campestris** Meigen

— Segmental ornamentation of bifid or tufted hairs, not heavily sclerotized . 47

47 Anterior trifurcate thorn-like appendages present lateral to anterior respiratory cornu (fig. 8*A*); prolegs closely approximated along median line . . . . . (46) **Callicera rufa** Schummel

— Thorn-like appendages lacking between anterior cornu; prolegs separate . 48

48 Conspicuous claws much larger than spinules of integumental vestiture present 49
— Claws absent, or minute claws about the size of integumental vestiture only present 50
49 A pair of lateral fleshy lobes with an apical tuft of hairs close to base of sclerotized posterior respiratory process . . . . (47) **Xylota sylvarum** (L.)
— A pair of fleshy projections situated on tapering post-anal region of body, but well removed from base of sclerotized posterior respiratory process (fig. 7*D*) (48) **Pocota personata** (Harris)
50 Three pairs of lateral fleshy projections, the most posterior pair lateral and ventral to the posterior respiratory process, a pair on each of the two preceding segments . . . . . (49) **Syritta pipiens** (L.)
— A pair of fleshy projections lateral and ventral to the posterior respiratory process, a pair of twin tubercles anterior and slightly dorsal to posterior projections, and a third pair of fleshy projections anterior and dorsal to twin tubercles (fig. 8*D*) 51
51 Groove between tubercles bearing antennae shallow or absent (fig. 8*F*); anal tubercles appreciably darker than rest of body; mandibular sclerites with rarely less than six teeth, usually seven; relative dimensions of these sclerites as in fig. 8*B* . . . . . (50) **Eumerus strigatus** (Fallén)
— Groove between tubercles bearing antennae very pronounced (fig. 8*G*); anal tubercles only slightly darker than rest of body; mandibular sclerites bearing five, or occasionally six, teeth; dimensions of these sclerites as in fig. 8*C* . . . . . (51) **Eumerus tuberculatus** Rondani
52 Longitudinal tracheal trunks undulating when viewed from above (52) **Helophilus pendulus** (L.)
— Longitudinal tracheal trunks straight when viewed from above 53
53 Basal segment of posterior respiratory process with two basal pairs, a distal pair and one median pair of lateral papillae (fig. 8*L*) (53) **Mallota cimbiciformis** (Fallén)
— Basal segment of posterior respiratory process without papillae 54
54 Larva slightly dorso-ventrally flattened; anterior and lateral margins of body produced ventrally to give a leach-like appearance; a longitudinal furrow on either side of body . . . . . (54) **Myiatropa florea** (L.)
— Larva subcylindrical; longitudinal furrows of body absent 55
55 Larva with second segment of posterior respiratory process less than one-third length of first segment when fully extended; 12 anal gills present (55) **Eristalis aeneus** (Scopoli)
— Larva with second segment of posterior respiratory process at least one-third length of first segment when posterior respiratory process fully extended; 20 anal gills present . . . . . (56) **Eristalis tenax** (L.)

III. Descriptions of Larvae

Microdon Meigen

Generic characters: larvae broad, oval from above, hemispherical in cross-section; ventral sole flat, smooth; transverse wrinkles absent; segmentation not discernible; fleshy projections and prominences absent; prolegs and claws absent; segmental ornamentation absent; anterior cornu absent; feeding habits not known; found in ants' nests; posterior respiratory process posterodorsal.

1. *Microdon mutabilis* (L.)
(after Andries, 1912)

Length 11 mm., width 9·5 mm.; dull white, opaque; dorsal surface coarsely rugose with irregular polygonal patterns.

Posterior respiratory process: longer than in *M. eggeri*; brightly shining, constricted after basal rim, parallel sided, rounded at apex; a pale lobular pattern on each spiracular plate.

Previous descriptions: Poujade (1883), Hecht (1899), Andries (1912), Sack (1930).

2. *Microdon eggeri* Mik (Figs. 1*G*, 1*H*, 1*J*)

Length 8–9 mm., width 6–7·5 mm., height 4 mm. ; dull brown ; dorsal surface with a reticulate pattern of papillae ; a fringe of close-set alternating single and Y-shaped spinules surrounding margin of body except anterior to mouth ; body finely papillose ; external mouth parts absent ; mouth ventral.

Posterior respiratory process : three-fourths as long as broad ; constricted at base ; narrowing towards rounded apex, almost oval in end view ; median longitudinal groove present at apex ; circular plates small, oval, anterior, internal to prominences bearing spiracular openings ; dorsal spurs absent ; interspiracular ornamentation of four pairs of hairs ; numerous minute, oval spiracular openings scattered on two oval nodular prominences.

Source of material : Collected in Oxford in June by Dr. A. J. Pontin from a nest of *Lasius niger* (L.).

Previous descriptions : Andries (1912), Krüger (1926).

3. *Microdon devius* (L.) (Fig. 1*K*)

Length 10 mm., width 7 mm., height 5 mm. (1 specimen) ; dorsal surface with a reticulate pattern of papillae ; a fringe of close-set alternating pointed and Y-shaped spinules surrounding margin of body except anterior to mouth ; external mouth parts absent ; mouth ventral.

Posterior repiratory process : one and one-fourth times as long as broad ; constricted near the base ; parallel sided, rounded at apex ; almost round in end view ; median longitudinal groove separating spiracular plates posterior to circular plates only ; circular plates close to median line ; dorsal spurs absent ; interspiracular ornamentation of small hairs ; numerous minute oval spiracular openings on margins of a pale lobular pattern on each spiracular plate.

Source of material : Specimen without data, from a collection in the Hope Department of Entomology, Oxford.

Previous description : Vimmer (1925).

Volucella Mueller

Generic characters : dorso-ventrally flattened, parallel-sided, rounded posteriorly when viewed from above, dorsal surface flat, tapering anteriorly ; transversely wrinkled ; prolegs with claws present ; found in nests of wasps, hornets and bumble bees ; carnivorous or scavenging.

4. *Volucella inanis* (L.) (Figs. 1*B*, 1*D*)

Length 16 mm., width 7·5 mm., height 4·5 mm. (1 specimen) ; greyish-brown ; dorsoventrally flattened, tapering broadly anteriorly, rounded posteriorly ; fleshy projections absent ; seven pairs of prolegs each with a row of up to nine large curved claws, thoracic pair contiguous, six abdominal pairs well separated ; integumental vestiture of dark spinules, denser on dorsal surface, a group of rounded cone-shaped sclerotized structures separate the segmental spines of segments 1 and 2 ; segmental spines bifid, in rows of 6, 10, 16, 16, 18, 18, 18, 18, 18, 18, 20 and 10, respectively ; anterior cornu oval from above, truncate.

Posterior respiratory process : terminal, twice as long as broad, entirely sclerotized along its length, basal half slightly wider than terminal half ; angle between spiracular plates less than 180° ; dorsal spurs, interspiracular ornamentation and carinae absent ; nine pairs of unequal, narrow, convoluted and dentate spiracles radiating from central plates.

Source of material : British Museum (Natural History).

Previous description : Künckel d'Herculais (1875).

5. *Volucella bombylans* (L.)
(after Lundbeck (1916))

Length about 20 mm. ; dorsoventrally flattened, parallel-sided, rounded posteriorly when viewed from above, tapering anteriorly ; transverse wrinkles deep ; a semicircle of six long

fleshy projections on hind margin of body ; seven pairs of prolegs present each with two rows of recurved claws.

Posterior respiratory process : postero-dorsal.

Previous descriptions : Künckel d'Herculais (1875), Lundbeck (1916).

6. *Volucella zonaria* (Poda)

Length 19 mm., width 7 mm., height 5 mm. ; dorsal surface flat, sloping anteroventrally on segments 4 and 5, and postero-ventrally on segments 10 and 11 ; ventral surface convex in cross-section ; two pairs of lateral fleshy projections on margin of dorsal surface of segments 5–11 ; a row of six projections across dorsal surface of segments 3 and 4 ; six projections on margin of dorsal surface of segment 12 ; two pairs of lateral fleshy projections on segments 5–11 forming a longitudinal row along the body ; a smaller plumper projection between dorsal and lateral projections on segments 5–10, and four on segment 12 ; six pairs of prolegs present with two rows of claws ; integumental vestiture of sclerotized conical processes, vestiture on projections spikes ; larger bifid, trifid or stellate structures on crest of each transverse ridge of dorsal surface ; segmental ornamentation on a pair of mid-lateral processes (segments 5–11) between an anterior (segments 6–10) and posterior median (segments 5–11) pair in addition to apical spikes on fleshy projections, in all twelve spikes on segments 3 and 4, sixteen on segment 5, eighteen on segments 6–10, fourteen on segment 11, and ten on segment 12.

Posterior respiratory process : situated in a slight depression, postero-dorsal ; sclerotized, rugose ; constricted halfway along its length ; median depression between spiracular plates shallow, narrow ; dorsal spurs absent ; circular plates large, separated by one-third their diameter ; interspiracular ornamentation of four pairs of tufts of branched hairs ; three pairs of convoluted, dentate spiracles with internal bars, surrounding central plates, and symmetrical on each spiracular plate.

Source of material : Collected by the late Dr. F. I. van Emden from a nest of *Vespa vulgaris* (L.).

Previous description : Künckel d'Herculais (1875).

7. *Volucella pellucens* (L.) (Figs. 1*A*, 1*E*)

Length 12–13 mm., width 4–5 mm., height 4–4·5 mm. ; body form as in *V. zonaria*, except segment 5 has four prominences in a transverse row and two posterior prominences.

Posterior respiratory process : as in *V. zonaria* except smaller, and circular plates separated by only one-sixth of their diameter.

Source of material : British Museum (Natural History).

Previous descriptions : Künckel d'Herculais (1875), Lundbeck (1916), Krüger (1926).

8. *Merodon equestris* (Fabricius) (Fig. 1*F*)

Length 15–20 mm., width 5–6 mm., height 5–6 mm. ; cream or pale brownish-yellow ; subcylindrical, tapering slightly anteriorly, rounded posteriorly ; transverse wrinkles deep ; prolegs and claws absent ; a pair of ventrolateral papillae posterior to respiratory process ; two dorsolateral convex oval areas present on segment 5 ; integumental vestiture of pale curved spinules ; segmental ornamentation of 10, 6, 16, 12, 14, 14, 14, 14, 14, 14, 14, and 8 long hairs on successive segments ; mouth hood large, black, serrate and posteriorly directed ; phytophagous, in bulbs.

Fig. 1.—(*A*) *Volucella pellucens*, prolegs with claws ; (*B*) *V. inanis*, prolegs with claws ; (*C*) *Chrysotoxum verralli*, surface view of spiracular plates ; (*D*) *Volucella inanis*, surface view of spiracular plates ; (*E*) *V. pellucens*, part of dorsal surface of larva showing lateral projections and dorsal ornamentation ; (*F*) *Merodon equestris*, anterior view of larva showing prominent mouth hood ; (*G*) *Microdon eggeri*, fringe of spinules which surrounds ventral sole ; (*H*) the same, surface view of spiracular plates ; (*J*) the same, side view of larva ; (*K*) *M. devius*, surface view of spiracular plates.

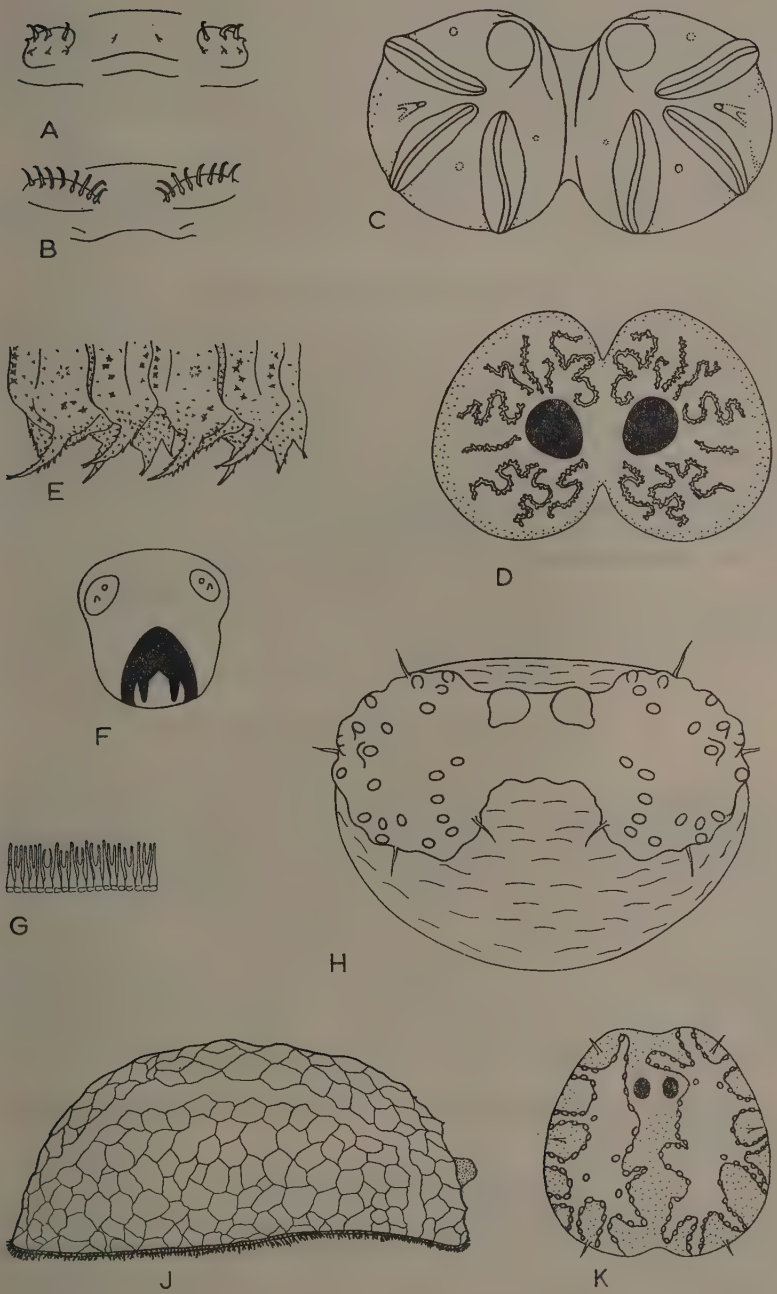

Fig. 1.—For details see facing page.

Posterior respiratory process : postero-dorsal ; as long as width at apex, oval from above, constricted one-third length from base ; marked with longitudinal furrows from constriction to apex ; base one and three-fourths as broad as apex ; median groove between spiracular plates absent ; circular plates large, oval, depressed, and straight along inner edge ; interspiracular ornamentation of four tufts of palmate hairs on periphery of each spiracular plate ; three pairs of asymmetrically convoluted spiracles ; spiracles not denticulate, and not mounted on carinae, surround circular plates.

Source of material : British Museum (Natural History).
Previous descriptions : Hodson (1932*a*), Heiss (1938), Doucette *et al.* (1942).

9. *Xanthogramma pedissequum* (Harris)

Length 10 mm., width 5 mm., height 4 mm. (1 specimen) ; uniform cream without markings, smooth, shining ; subcylindrical, tapering anteriorly, rounded posteriorly ; segmentation indistinct ; transverse wrinkles fine and equally spaced ; longitudinal wrinkles and ridges absent ; prolegs and claws and fleshy projections and prominences absent ; integumental vestiture and papillae absent ; segmental ornamentation of minute conical hairs on papillae of equal length.

Posterior respiratory process : postero-dorsal ; as long as broad ; rounded at apex, entirely sclerotized, and constricted halfway along length ; spiracular plates not separated by a median groove ; circular plates extremely small, slightly larger than pits of interspiracular ornamentation ; dorsal spurs absent ; interspiracular ornamentation of four pairs of single fine hairs each arising in a small circular pit set well in from the periphery of spiracular plates ; three pairs of convoluted spiracles not mounted on carinae, but radiating from circular plates.

Source of material : Collected in Oxford in June by Dr. A. J. Pontin from a nest of *Lasius niger* containing *Trama* sp.
Previous description : Beling (1882).

10. *Chrysotoxum verralli* Collin (Fig. 1*C*)
(previously undescribed)

Larva uniform cream ; nearly cylindrical, tapering anteriorly, truncate posteriorly ; numerous fine transverse wrinkles present ; a fleshy prominence present on each side of posterior respiratory process ; prolegs and claws absent ; integumental vestiture absent ; body papillose ; segmental ornamentation consisting of single hairs each mounted on a papilla ; larva with internal and external mouth hooks ; mature larva found in ants' nest, feeding habits unknown.

Posterior respiratory process : postero-dorsal ; as long as breadth at base ; entirely sclerotized ; basal half nodular, apical half smooth ; spiracular plates separated by a median groove ; dorsal spurs consisting of rim around inner anterior edge of circular plates ; circular plates on inner anterior edge of spiracular plates ; interspiracular ornamention of four pairs of small nodules ; an inner opening present between spiracles I and II ; three pairs of equidistant straight narrow spiracles mounted on slight carinae with faint longitudinal striations, spiracles radiating on each spiracular plate, inner ends almost meeting, spiracles III parallel, spiracles I and III 135° apart.

Source of material : Collected by Dr. A. F. G. Dixon from a nest of *Lasius niger* at Aberlady Bay in May.

Platycheirus St. Fargeau and Serville

Generic characters : body subcylindrical, tapering anteriorly, and cuspidate posteriorly ; a dorsolateral ridge present on either side ; transversely wrinkled ; prolegs and claws absent ; fleshy projections absent ; integumental vestiture absent ; body papillose ; segmental ornamentation of conical hairs mounted individually on papillae ; external mouth hooks present ; aphidophagous ; posterior respiratory process postero-dorsal, sclerotized ; median groove separating spiracular plates ; dorsal spurs absent ; an opening present between spiracles I and II ; three pairs of elongate-oval spiracles radiating and situated on a pale or dark area differentiated from remainder of spiracular plates ; spiracles not mounted on carinae.

11. *Platycheirus scutatus* (Meigen)

Length 9–10 mm., width 2 mm., height 1·5 mm.; green (turning grey or lavender after cessation of feeding) with five anteriorly directed cream or pink chevrons, scattered pink flecks, and a pink line of adipose tissue in each dorso-lateral ridge.

Posterior respiratory process: as long as broad; nodular; basal half pale, delimited by a constriction; distal half darker; spiracular plates smooth and separated by a median groove with a nodular surface; circular plates oval to kidney shaped, anterior and median to inner ends of spiracles I, and with the smallest diameter greater than length of a spiracle; interspiracular ornamentation of four pairs of setae, these setae as long as width of a spiracle; spiracles short, equidistant; interspiracular ornamentation and spiracles situated on a pale almost semi-circular area extending to anterior and outer margins of spiracular plates, but not to posterior margins.

Source of material: Collected from trees, shrubs and herbs at Silwood Park, Berks. from April to February.

Previous descriptions: Krüger (1926), Bhatia (1939), Scott (1939), Dunn (1949), Fielding (1953).

12. *Platycheirus albimanus* (Fabricius) (Fig. 2*A*)

Average length 7 mm., width 1·5 mm., height 1 mm.; larva transparent; pale brown adipose tissue arranged in four chevrons on abdominal segments, and in a line in each dorsolateral ridge.

Posterior respiratory process: three-fourths as long as broad; constricted one-third distance from base; pale; smooth; circular plates oval, anterior and median to inner ends of spiracles I; interspiracular ornamentation of four pairs of paired setae; spiracles II nearer to III than to I; interspiracular ornamentation and spiracles situated on a pale area.

Source of material: Collected from trees, shrubs and herbs at Silwood Park from April to February.

Previous description: Fielding (1953).

13. *Platycheirus manicatus* (Meigen) (Fig. 2*B*)

Size and colour as in *P. clypeatus*.

Posterior respiratory process: half as long as broad; pale; a fleshy rim at base; spiracular plates smooth and separated by a wide median groove with a nodular surface; circular plates round and on a level with inner ends of spiracles I; interspiracular ornamentation of four pairs of setae, these setae as long as width of a spiracle; spiracles equidistant; interspiracular ornamentation and spiracles situated on a pale area extending to outer margin but not to anterior and posterior margins of spiracular plates.

Source of material: Larvae reared from eggs laid by a gravid female captured at Silwood Park in May.

Previous descriptions: Dunn (1949), Fielding (1953).

14. *Platycheirus clypeatus* (Meigen) (Fig. 2*C*)

Length 9–11·5 mm., width 2 mm., height 1·75 mm.; tan with a paler line on each dorsolateral ridge.

Posterior respiratory process: truncate; one and a half times as broad as long; constricted between one half and one-third distance along length; base paler than distal part; spiracular plates round; median groove with a longitudinally reticulate surface; circular plate round, with diameter equal to length of spiracle I, and posterior extremity on a level with anterior margins of spiracles II; interspiracular ornamentation of four pairs of setae; interspiracular setae and spiracles situated on a pale area extending to anterior and outer margins of spiracular plates, but not posterior margin.

Source of material: Larvae reared from eggs laid by a gravid female captured at Silwood Park in May.

Previous description: Fielding (1953).

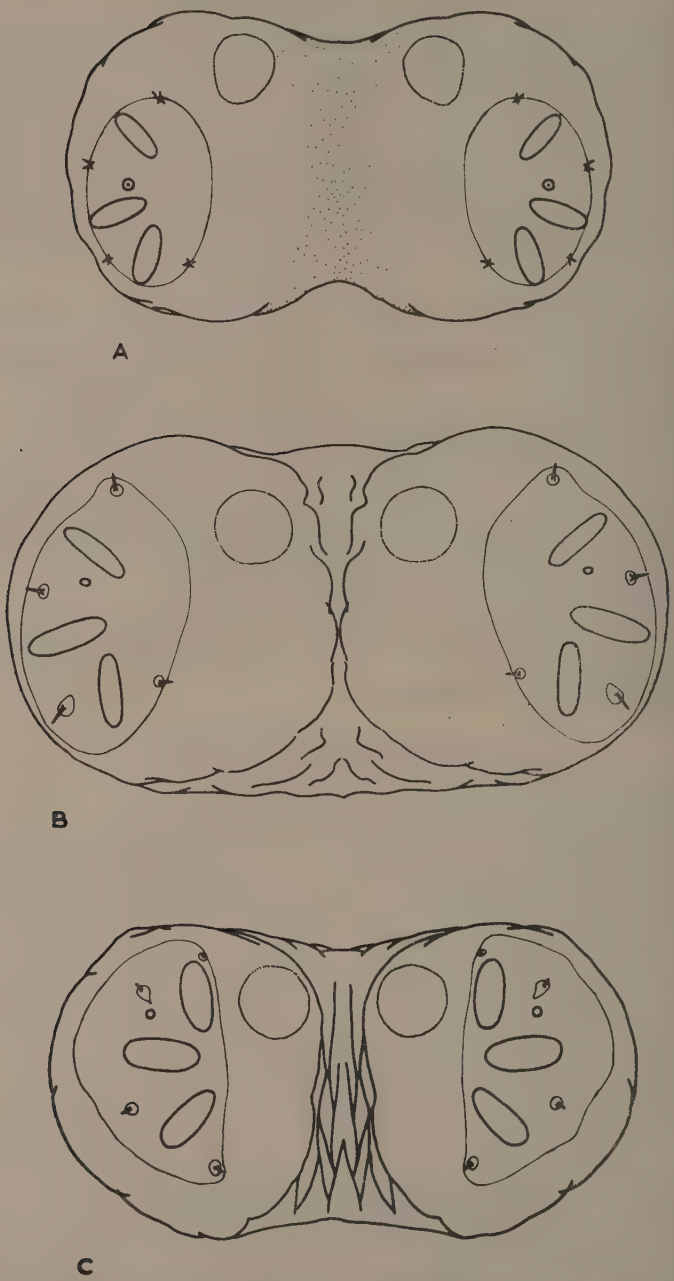

Fig. 2.—Surface view of spiracular plates of: (*A*) *Platycheirus albimanus*; (*B*) *P. manicatus*; (*C*) *P. clypeatus*.

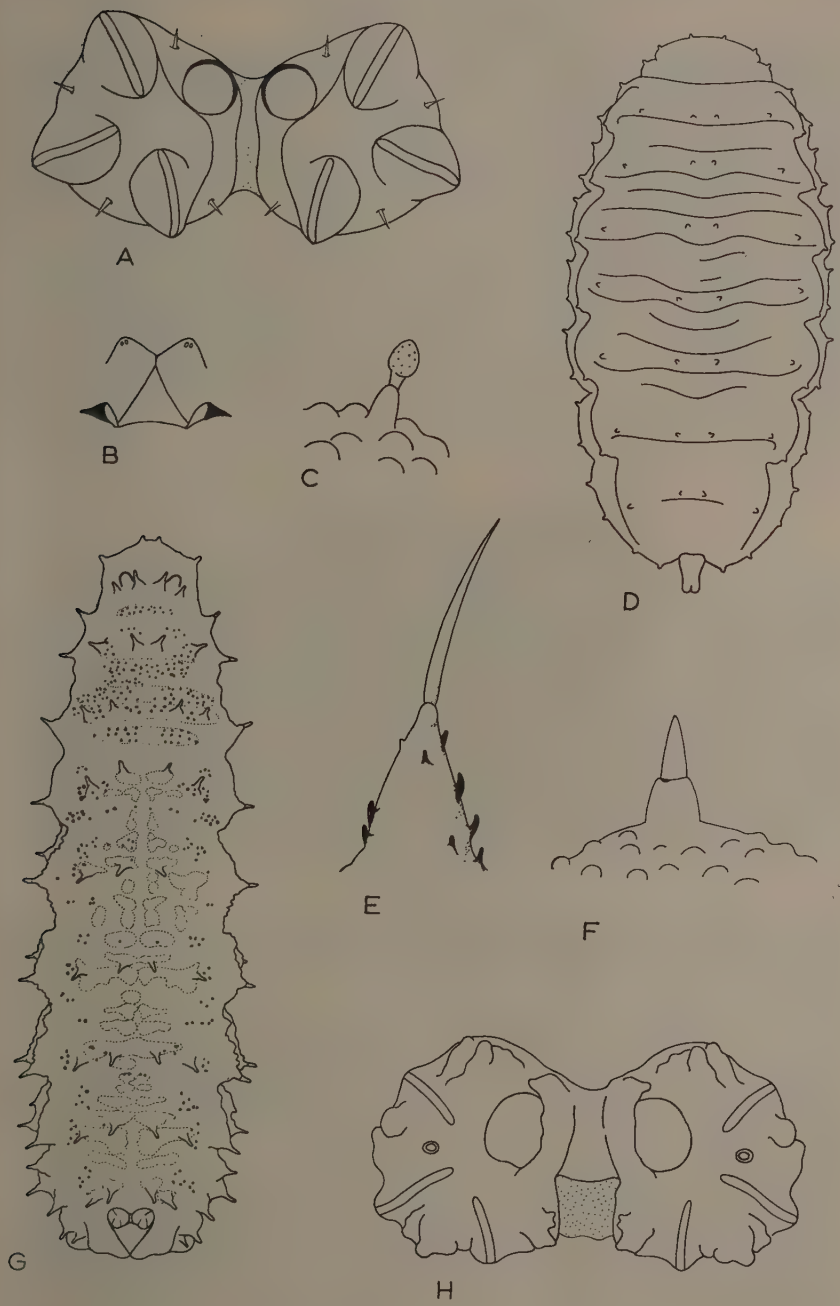

FIG. 3.—(*A*) *Pipizella varipes*, surface view of spiracular plates; (*B*) *Syrphus ribesii*, external mouth hooks below antennal papillae; (*C*) *Pipizella varipes*, segmental hair; (*D*) the same, dorsal view of larva; (*E*) *Syrphus albostriatus*, segmental spine; (*F*) *S. triangulifer*, segmental hair; (*G*) *S. luniger*, dorsal view of larva; (*H*) *S. eligans*, surface view of spiracular plates.

15. *Baccha elongata* (Fabricius)
(previously undescribed)

Average length 9·5 mm., width 1·5 mm., height 1 mm. ; pale grey with a buff pink longitudinal band on either side of heart line extending laterally to dorsolateral ridges, and joined along median line on segment 4 ; each band divided and divergent posteriorly from segment 10 and anteriorly from segment 8 ; salivary glands faintly visible on segment 4 ; subcylindrical, tapering anteriorly, cuspidate posteriorly ; a dorsolateral longitudinal ridge on either side of the body ; transversely wrinkled ; fleshy projections and prominences absent ; prolegs and claws absent ; integumental vestiture absent ; segmental ornamentation of microscopic pointed hairs mounted on individual papillae ; external mouth hooks present ; aphidophagous.

Posterior respiratory process : postero-dorsal, almost as long as broad ; spiracular plates separated by a median groove ; circular plates oval to kidney-shaped, median and anterior to inner ends of spiracles I ; dorsal spurs present as short inconspicuous folds well separated and median to circular plates ; interspiracular ornamentation of five pairs of openings, two pairs of openings between spiracles I and II ; three pairs of short, straight, spiracles four times as long as wide not mounted on carinae, and situated on areas sometimes pale and sometimes black ; spiracles radiating on these areas.

Source of material : Collected from herbs at Silwood Park from June to August.

16. *Melanostoma scalare* (Fabricius)
(previously undescribed)

Length 9–9·5 mm., width 1·5 mm., height 1·5 mm. ; green ; gut contents appearing black where exposed between fat body tissue ; longitudinal tracheal trunks white ; subcylindrical, tapering anteriorly, rounded posteriorly but with a small median depression when viewed from above ; longitudinal dorsolateral ridges absent ; transverse wrinkles fine ; fleshy projections and prominences absent ; prolegs and claws absent ; integumental vestiture absent ; body papillose ; segmental ornamentation microscopic ; external mouth hooks present ; aphidophagous.

Posterior respiratory process : postero-dorsal ; half as long as broad ; smooth, shining ; spiracular plates separated by a median groove ; circular plates round, median, displaced anteriorly, diameter of circular plate greater than length of a spiracle ; dorsal spurs absent ; interspiracular ornamentation of five openings on each spiracular plate ; two of these openings between spiracles I and II ; three pairs of straight, roundish-oval spiracles with a fringe of inwardly directed hairs from the border on each ; not mounted on carinae ; II nearer to III than to I.

Source of material : Collected from herbs and shrubs at Silwood Park from April to February.

17. *Sphaerophoria scripta* (L.)

Average length 8 mm., width 1·5 mm., height 1·5 mm. ; green with a wide white dorsal band on either side of the heart line ; subcylindrical, tapering anteriorly, truncate posteriorly ; dorsolateral longitudinal ridges absent ; transversely wrinkled ; fleshy projections and prominences absent ; prolegs and claws absent ; integumental vestiture absent ; segmental ornamentation microscopic ; external mouth hooks present ; aphidophagous.

Posterior respiratory process : postero-dorsal ; one to one and a half times as long as broad ; spiracular plates separated by a median groove ; circular plates round, sloping antero-ventrally, displaced towards median line, and anterior to inner ends of spiracles I ; dorsal spurs absent ; interspiracular ornamentation of five pairs of openings, two pairs between spiracles I and II ; three pairs of straight, wide spiracles mounted on carinae ; fringe of microscopic hairs projecting inwards from borders of spiracles.

Source of material : Collected from shrubs and herbs at Silwood Park from July to October.

Previous description : Bhatia (1939).

18. *Pipiza noctiluca* (L.)
(previously undescribed)

Length 8–9 mm., width 2·5 mm., height 2 mm. ; either uniform olive green without markings, or pale grey with two bright yellow tracheae visible through integument, larva turning completely buff or dark brown before pupation ; tapering anteriorly, dorsoventrally depressed ; scalloped in outline ; transversely wrinkled ; fleshy projections absent, a fleshy tubercle present on either side postero-ventral to posterior respiratory process ; prolegs and claws absent ; dense integumental vestiture of colourless conical spinules present ; segmental ornamentation of colourless conical short spines mounted on individual papillae, eight on segment 3, ten on segment 4, twelve on segments 5–11, and four on segment 12 ; external mouth hooks present ; aphidophagous.

Posterior respiratory process : postero-dorsal ; one and a half times as long as broad ; constricted halfway along length ; entirely sclerotized ; nodular ; spiracular plates separated by a median groove ; circular plates round, anterior to inner end of spiracle I ; dorsal spurs absent ; interspiracular ornamentation of four pairs of setae, an inner opening present between spiracles I and II ; three pairs of straight spiracles mounted on wide carinae ; fringe of teeth projecting inwards from borders of spiracles ; II nearer to III than to I.

Source of material : Collected from shrubs and herbs at Silwood Park in June and July.

19. *Didea fasciata* Macquart
(after Metcalf (1916), Heiss (1938))

Length 12–15 mm., width 5–6 mm., height 3–4 mm. ; mottled greyish-brown and dark brown, with heart, apices of median segmental lobes, entire dorsal lobes, and irregular dorsal diamonds black ; base of median lobes, and apices of dorsoventral, lateral and ventrolateral lobes bright yellow ; ventral sole lavender coloured ; flattened, about twice as broad as high, obtuse anteriorly, truncate posteriorly ; transversely wrinkled ; prolegs and claws absent ; dorsal vestiture of black setae ; fleshy lobes pointed and bearing segmental spines twice as long as integumental spines ; external mouth hooks absent ; aphidophagous.

Posterior respiratory process : recessed in a postero-dorsal depression ; broader than long ; entirely sclerotized ; spiracular plates separated by a median groove and lamellate in surface view ; circular plates small, anterior to spiracles ; three pairs of equidistant, sinuous spiracles mounted on carinae ; each spiracle between a pair of lamellae as high as carinae.

Previous descriptions ; Metcalf (1911, 1913*a*, 1916), Heiss (1938).

Scaeva Fabricius

Generic characters : subcylindrical ; fleshy projections absent ; claws absent ; dorsally integumental vestiture uniform except on posterior segment ; segmental ornamentation of long hairs mounted individually on papillae ; external mouth hooks present ; aphidophagous ; posterior respiratory process postero-dorsal ; at least twice as broad as long ; entirely sclerotized ; spiracular plates separated by a median groove ; interspiracular ornamentation of four nodules between inner ends of spiracles on each spiracular plate, an opening between spiracles I and II ; three pairs of straight spiracles mounted on carinae.

20. *Scaeva pyrastri* (L.) (Fig. 4*B*)

Length 14–16 mm., width 3 mm., height 2·5 mm. ; light green, uniformly flecked with white, with a median dorsal white, cream or pink stripe, and a fine dorsolateral line on either side ; subcylindrical, tapering anteriorly, cuspidate posteriorly ; outline serrate ; ventral sole with seven segmentally arranged pairs of two small prominences ; integumental vestiture of pale brown spinules ; segmental ornamentation of long hairs each mounted on a papilla on a prominence in ten rows as described in *S. selenitica*.

Posterior respiratory process : recessed in a triangular depression in which integumental vestiture is sparser and finer ; sessile ; less than a quarter as long as broad ; respiratory tubes fused only along basal line ; a deep cleft present separating each spiracular plate ; circular plates slightly anterior to centre of each spiracular plate ; dorsal spurs absent ; spiracles mounted on high carinae, II and III almost parallel ; spiracles with an inner border of hairs.

Source of material : Collected from shrubs and herbs at Silwood Park from May to July.

Previous descriptions : Jones (1922), Campbell and Davidson (1924), Krüger (1926), Fluke (1929), Heiss (1938), Bhatia (1939), Scott (1939), Brauns (1954).

21. *Scaeva selenitica* (Meigen) (Fig. 4*C*)
(previously undescribed)

Length 18–19 mm., width 4 mm., height 3·5 mm. ; light green with a white median line of adipose tissue superimposed upon a broad median dark brown band, the white line interrupted by five transverse rows of orange-brown adipose tissue between dorsal segmental hairs on abdominal segments, aggregations of white adipose tissue forming flecks especially concentrated in dorso-lateral prominences ; subcylindrical, tapering anteriorly, cuspidate posteriorly ; serrate in outline ; ventral sole with seven segmentally arranged pairs of two prominences ; integumental vestiture of dense dark brown spinules ; segmental ornamentation of long hairs mounted on individual papillae on slight prominences in ten rows of 12, 18, 16, 12, 12, 12, 12, 12, 12, and 2 respectively.

Posterior respiratory process : recessed in a triangular depression where integumental vestiture is finer and denser ; twice as broad as long ; constricted at the base ; median groove slightly less than half as deep as length of respiratory process ; circular plates elongate oval, displaced towards the median groove and anteriorly ; dorsal spurs prominent, pointed, and contiguous with inner and part of posterior border of circular plates ; interspiracular ornamentation of small nodules ; spiracles straight, equidistant and on slightly raised carinae ; spiracles III parallel to median groove ; spiracles with an inner border of hairs.

Source of material : Collected by Dr. P. Harris from *Pinus* sp. near Sunninghill, Berks., in May and June.

Paragus Latreille

Generic characters : transversely wrinkled ; prolegs and claws absent ; integumental vestiture absent ; body papillose ; segmental ornamentation of blunt or pointed spines on fleshy elevations ; dorsal spines on some segments shorter than other spines on same segments ; mouth parts terminal, with two jaws, three pairs lateral and one pair outer mouth hooks ; aphidophagous ; posterior respiratory process postero-dorsal ; constriction separating basal and distal regions ; spiracular plates separated by a median groove ; dorsal spurs well developed ; three pairs straight spiracles on carinae radiating from circular plates.

22. *Paragus bicolor* (Fabricius)
(after Metcalf (1911) and Heiss (1938))

Length 7–8 mm., width about 3·25 mm., height about 2·5 mm. ; dun or translucent yellow without pattern except for the heart, or light yellowish-brown, semi-transparent, with a dorsal brick-red band about one-third width of the larva and a black median heart line, a black band on either side and a more lateral wide yellowish-white band ; elongate oval from above, dorso-ventrally flattened, gradually tapering, obtuse anteriorly, truncately rounded posteriorly ; segments 5–11 with seven pairs of rounded elevations functioning as prolegs ; segmental ornamentation of pointed spines on processes equally as long ; dorsal spines on segments 3 and 6–11 one-sixth as long as other spines.

Posterior respiratory process : broader than long (Heiss), slightly longer than broad (Metcalf) ; basal region roughly papillose, nearly black, separated from the smooth strongly sclerotized distal region by a constriction about halfway along the length ; dorsal spurs broad, long, hollowed at the base ; interspiracular ornamentation inconspicuous ; spiracles on well-developed carinae.

Previous descriptions : Metcalf (1911, 1913), Jones (1922), Sack (1929), Heiss 1938).

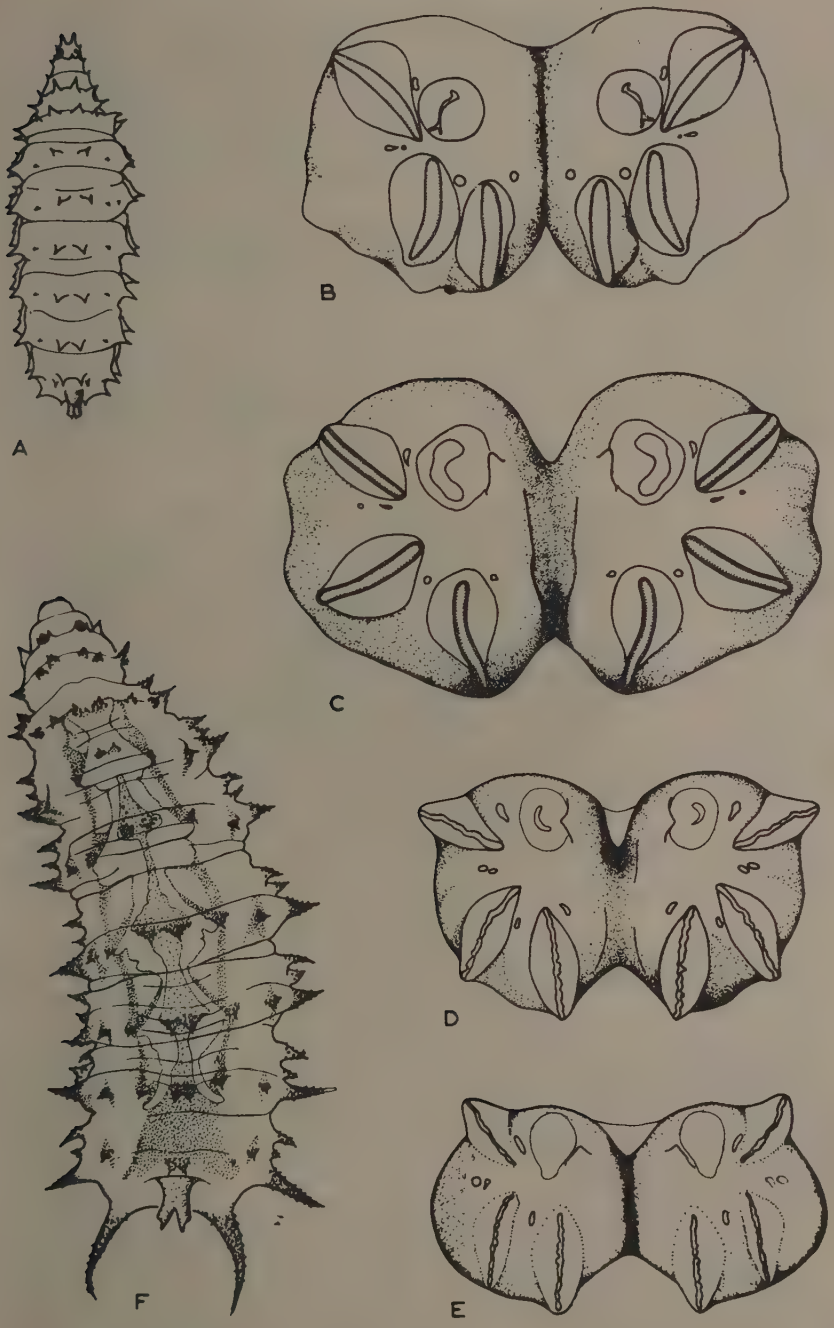

FIG. 4.—(*A*) *Paragus tibialis*, dorsal view of larva; (*B*)–(*E*) surface view of spiracular plates of: (*B*) *Scaeva pyrastri*, (*C*) *S. selenitica*, (*D*) *Syrphus luniger*, (*E*) *S. corollae*; (*F*) *S. albostriatus*, dorsal view of larva.

23. *Paragus tibialis* (Fallén) (Fig. 4*A*)
(partly after Metcalf (1911) and Heiss (1938))

Length 6–7 mm., width 2–2·2 mm., height 1·5 mm.; uniform pearly-white or light yellowish-brown; dark heart line usually prominent; dark line on each side under dorsal segmental spines often present with a reddish band of less extent than in *P. bicolor* and largely replaced by sulphur yellowish tinge; slenderer and smaller than *P. bicolor*, less flattened; segmental spines blunt, raised on small fleshy prominences and directed posteriorly on last three segments; dorsal spine one-third length of others on segments 6–11.

Posterior respiratory process: one and a half times as broad as long with a constriction about two-thirds along its length demarcating a basal nodular region; spiracular plates separated by a deep median groove; dorsal spurs long, pointed; interspiracular ornamentation of small nodules; spiracles arched on high carinae.

Source of material: Collected from *Sarothamnus scoparius* (L.) at Silwood Park in July.

Previous descriptions: Metcalf (1911, 1913), Campbell and Davidson (1924), Heiss (1938).

24. *Pipizella varipes* (Meigen) (Figs. 3*A*, 3*C*, 3*D*)

Average length 6 mm., width 2·25 mm., height 1 mm.; grey, turning yellowish-brown prior to pupation; dorsoventrally flattened, oval from above; transverse wrinkles present; fleshy projections and prominences absent; prolegs and claws absent; integumental vestiture absent; body papillose; external mouth hooks present; aphidophagous.

Posterior respiratory process: terminal; length equal to breadth at base; tapering from base to halfway along length, walls of apical half parallel; entirely sclerotized; nodular; spiracular plates separated by a median groove; dorsal spurs merely forming a rim around inner edge of circular plates; circular plates anterior, bordering median groove; interspiracular ornamentation consisting of four pairs of setae; three pairs of straight equidistant spiracles mounted on slight carinae, curving over edge of spiracular plates; angle between spiracles I and III just less than 180°.

Source of material: Collected from colonies of root aphids at Silwood Park in August.

Previous description: Heeger (1858).

25. *Leucozona lucorum* (L.)
(previously undescribed)

Average length 10–15 mm., width 3·5 mm., height 2 mm.; brown with yellow-orange chevrons; dorsoventrally flattened, tapering anteriorly, cuspidate posteriorly, scalloped in outline; transverse wrinkles present; fleshy projections and prominences absent; ventral sole present; integumental vestiture absent; body papillose; segmental ornamentation of single spines each mounted on a papilla, twelve spines on segments 4–11, eight on segment 12; external mouth hooks present; aphidophagous.

Posterior respiratory process: postero-dorsal; one and a half times as long as broad at the base, basal two-thirds parallel-sided, nodular; apical one-third rounded, smooth, a constriction separating basal and apical parts; entirely sclerotized; spiracular plates separated by a pronounced median groove; hind margin of circular plates just posterior to inner end of spiracles II, circular plates towards median groove; apices of well-developed triangular dorsal spurs between inner ends of spiracles II; interspiracular ornamentation of large prominences, an inner opening between spiracles I and II; three pairs of straight spiracles mounted on slight carinae curving over edge of spiracular plates when viewed from above, spiracles radiating on each spiracular plate.

Source of material: Collected from *Rumex* sp. at Silwood Park in June and July.

26. *Syrphus albostriatus* (Fallén) (Figs. 3*E*, 4*F*, 5*C*)

Length 10–12·5 mm., width 3 mm., height 3 mm.; body cream mottled with brown; a forwardly directed cream V-shaped marking on segments 6–10; median dorsal and dorsal fleshy projections dark brown; diffuse lateral line, and dorsolateral line connecting segmentally arranged dark brown postero-laterally directed bands, dark brown; tapering anteriorly from segment 11, truncate posteriorly; triangular in cross-section; a row of ten, sixteen and fourteen fleshy projections on segments 2, 3 and 4, respectively, segments 5–11 each with one pair of median dorsal and three pairs of lateral projections; posterior pair of lateral projections tending to be the largest; middle pair smallest, slightly ventral to other two; segments 5–11 with smaller pair of dorsal and dorsolateral projections between posterior lateral projections; integumental vestiture of conical structures most abundant on fleshy projections and on posterolaterally directed dark brown markings on segments 5–11; prolegs and claws absent; segmental ornamentation of long pointed hairs, each mounted on a fleshy projection; as many segmental hairs present as fleshy projections.

Posterior respiratory process: as long as breadth at base; sclerotized; nodular; narrowing along the length to a wide constriction halfway, then divergent at the same angle; apically divided by a median groove one-third length of respiratory process; circular plates small, round; dorsal spurs as high as length of a spiracle; interspiracular ornamentation of elongate ridges parallel to spiracles; spiracles straight, mounted on carinae arranged vertically on end of respiratory process.

Source of material: Collected from trees, shrubs and herbs at Silwood Park in June and July.

Previous descriptions: Scott (1939), Brauns (1954).

27. *Syrphus tricinctus* (Fallén) (Fig. 5*A*)
(previously undescribed)

Length 10 mm., width 3 mm., height 3 mm.; body colour and form as in *S. albostriatus*; anterior two pairs of lateral projections smaller than in *S. albostriatus*.

Posterior respiratory process: as long as breadth at base; sclerotized; apical half nodular, basal half ridged; median groove as in figure 5*A*; dorsal spurs well developed but not as high as length of a spiracle; circular plates sloping upwards towards dorsal spurs; interspiracular ornamentation of rounded nodules; spiracles straight, mounted on carinae.

Source of material: Collected from *Quercus* sp. at Silwood Park in August.

28. *Syrphus corollae* (Fabricius) (Fig. 4*E*)

Length 11–12·5 mm., width 3 mm., height 3 mm.; colour and body form as in *S. luniger*; spinules shorter and less dense than in *S. luniger* with conspicuous discrete groups with dark circular bases lateral to each dorsolateral prominence.

Posterior respiratory process: recessed in a triangular depression, sessile, completely sclerotized, a quarter as long as broad; circular plates as in *S. luniger*; dorsal spurs prominent; interspiracular ornamentation of four pairs of inconspicuous nodules by inner ends of spiracles; spiracles straight, mounted on dark brown carinae; II and III parallel, but slightly divergent distally, III on the edge of median groove, I and II diverging by 90°.

Source of material: Collected from shrubs and herbs at Silwood Park from May to October.

Previous descriptions: Vimmer (1925), Scott (1939: not distinguished from *S. luniger*), Fielding (1953).

29. *Syrphus luniger* Meigen (Figs. 3*G*, 4*D*)

Length 12–13 mm., width 2–2·5 mm., height 2·5–3 mm.; dark brown or grey; small white, cream or pink aggregations of fat body arranged in six to seven diffuse forwardly projecting arrowheads, and concentrated in the segmental prominences bearing segmental hairs; subcylindrical, tapering anteriorly and cuspidate posteriorly; outline serrate; ventral sole with seven paired segmentally arranged prominences; dorsal integumental vestiture composed of single and

some bifid spinules, colourless on the segmental prominences otherwise dark brown; groups of spinules on transverse folds of body between the segmental prominences especially conspicuous; ventrally integumental vestiture pale and inconspicuous; segmental ornamentation of long colourless hairs arranged in a row of sixteen on segments 3–5, twelve on segments 6–11, and two on segment 12.

Posterior respiratory process: recessed in a triangular depression; sessile; a quarter as long as broad; spiracular plates separated by a deep groove; central plates anterior in position, slightly towards median groove; dorsal spurs prominent; interspiracular ornamentation consisting of four inconspicuous nodules by inner ends of spiracles; spiracles straight, with dentate edges and mounted on brown carinae; II and III divergent, III just outwards of the median groove, I and II diverging by 90°.

Source of material: Collected from shrubs and herbs at Silwood Park from May to October.

Previous descriptions: Vine (1895), Bhatia (1939), Scott (1939: not distinguished from *S. corollae*), Fielding (1953), Brauns (1954).

30. *Syrphus latilunulatus* Collin (previously undescribed)

Cream with white markings arranged as in *S. luniger*; shape and integumental vestiture as in *S. luniger*; segmental ornamentation as in *S. luniger*.

Posterior respiratory process: characters as in *S. luniger* except three-fourths as long as broad; with a constriction halfway along length; dorsal spurs sharp, pointed, their apices slightly higher than spiracles I when viewed from behind; carinae pale brown.

Source of material: Collected from *Cirsium arvense* (L.) at Bagshot, Surrey, in July.

31. *Syrphus nitidicollis* Meigen (previously undescribed)

Length 11–13 mm., width 4–5 mm., height 1·5–2 mm.; bright pea green to apple green turning brownish green during diapause, uniformly flecked with white, and with a median dorsal white or cream stripe; unusually flattened, ovate from above, dorsally convex; ventral sole broad and flat; first three segments ventral in resting position; integumental vestiture absent; body papillose; segmental hairs typical; four conical lateral prominences visible from above; first, third and fourth prominences on the same plane; first, second and third prominences bearing segmental hairs; median segmental hairs also mounted on small conical prominences.

Posterior respiratory process: one and a half times as long as width at the base; pale, nodular; base one and a half times as broad as apex; basal region tapering to a wide constriction two-thirds along the length, thereafter process widening to apex; dorsal spurs prominent; interspiracular ornamentation lamellate and well developed; spiracles straight, equidistant, raised on slight carinae, I and III diverging by 180°.

Source of material: Collected from shrubs and herbs at Silwood Park from May to July.

32. *Syrphus eligans* (Harris) (Figs. 3*H*, 6*D*)

Length 9–10·5 mm., width 4·25 mm., height 1·75 mm.; colour and general form as in *S. nitidicollis*; outline smooth; a lateral constriction between each segment; segmental hairs and papillae not mounted on conical elevations, lateral prominences absent; integument and segmental ornamentation as in *S. nitidicollis*.

Posterior respiratory process: twice as long as width at base; narrowing from base to about one-third the length, then parallel and widening slightly from distal third to apex; spiracular plates as in *S. nitidicollis*.

Source of material: Collected from shrubs and herbs at Silwood Park from May to July.

Previous descriptions: de Meijere (1916), Krüger (1926), Brauns (1953, 1954).

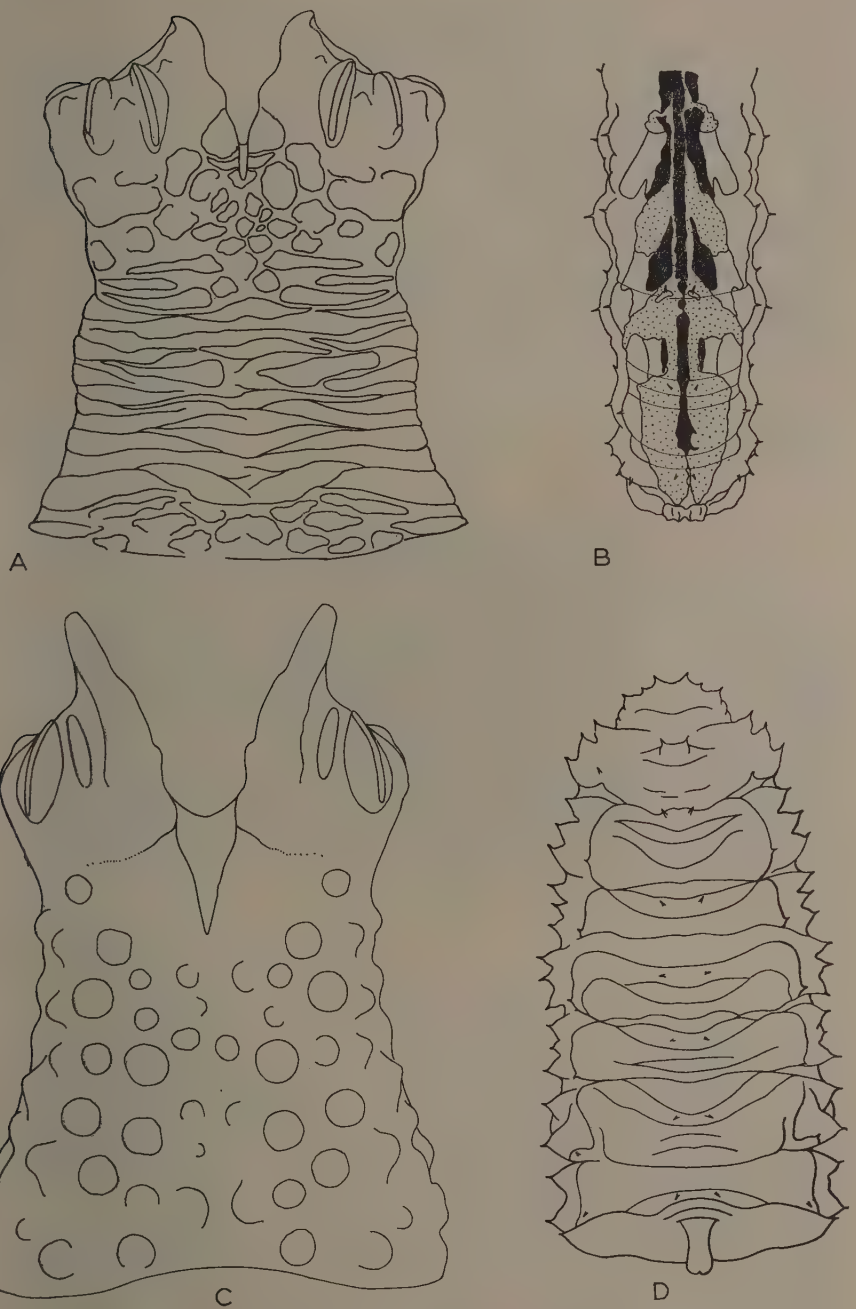

FIG. 5.—(*A*) *Syrphus tricinctus*, anterior view of posterior respiratory process; (*B*) *S. ribesii*, dorsal view of posterior segments showing pattern of underlying fat body; (*C*) *S. albostriatus*, anterior view of posterior respiratory process; (*D*) *S. guttatus*, dorsal view of larva.

33. *Syrphus guttatus* (Fallén) (Fig. 5*D*)

(previously undescribed)

Length 9 mm., width 2·5 mm., height 1 mm.; black; extremely flattened, outline as in figure 5*D*; transverse wrinkles deep; three pairs of lateral fleshy lobes and one pair median dorsal prominences on segments 5–11 and 4–11, respectively, all bearing segmental hairs; prolegs and claws absent; integumental vestiture absent; body papillose; segmental ornamentation typical, twelve hairs on segments 4–11 and two on segment 12.

Posterior respiratory process: twice as long as broad at the base, apex one-third width of base, sides of just less than apical half parallel; entirely sclerotized; black; walls entirely covered with nodules; spiracular plates smooth; circular plates anterior, towards median groove, sloping upwards towards dorsal spurs; dorsal spurs triangular, obtuse; interspiracular ornamentation of four pairs of setae each mounted on a nodule; straight spiracles mounted on smooth, high, rounded well developed carinae; angle between spiracles I and III less than 180°, II closer to III than to I.

Source of material: Collected by Dr. A. F. G. Dixon from *Acer pseudoplatanus* in Glasgow in September.

34. *Syrphus cinctus* (Fallén) (Fig. 6*B*)

(after Heiss (1938))

Length 10·5–13 mm., width 3–3·25 mm., height 2–2·5 mm.; ground colour dark brown, mottled with pink or orange; six black oval dots on dorsal surface; all but last surrounded by white chain-like pattern; lateral serrations edged with white bars extending forwards and inwards; dorsoventrally flattened, elongate oblong and tapering gradually anteriorly; lateral margin serrated with unequal lobe-like projections on three slightly different planes, largest above and slightly posterior to other two; each projection bearing a segmental spine; integumental vestiture absent; body papillose; segmental spines typical.

Posterior respiratory process: twice as long as broad; a basal nodular region extending two-thirds length of tube; distal third smooth with a deep median groove; circular plates anterior, towards median groove; dorsal spurs acute, hollowed at base and placed on inner anterior edge of spiracular plates; four pairs interspiracular setae present; spiracles straight, equidistant, and raised on high rounded carinae.

Previous description: Heiss (1938).

35. *Syrphus triangulifer* (Zetterstedt) (Figs. 6*A*, 6*C*)

Length 10–11 mm., width 2·5–3·5 mm., height 1·5–2·5 mm.; dark grey with three anteriorly directed pink arrowheads on segments 7–11, a median pink line extending from segment 4–6, and continuous dorsolateral pink line in ridge on either side; extremely flattened, about half as high as broad, triangular in cross-section, tapering anteriorly, gradually broadening and cuspidate posteriorly, corrugated in outline; a dorsolateral longitudinal undulating ridge present on either side; fleshy projections absent; integumental vestiture absent; body papillose; segmental ornamentation typical, twelve hairs on segments 4–11, and two on segment 12.

Posterior respiratory process: twice as long as broad, broadest at the base; entirely sclerotized; dark reddish-brown; walls covered with nodules for basal two-thirds, thereafter smooth; circular plates situated anteriorly, towards median groove; dorsal spurs well developed; four pairs interspiracular setae on nodules situated between and midway along length of spiracles; spiracles straight, mounted on slight carinae; angle between I and III just less than 180°, II slightly closer to III than to I.

Source of material: Collected from shrubs at Silwood Park from June to August.
Previous descriptions: Metcalf (1917), Jones (1922), Heiss (1938).

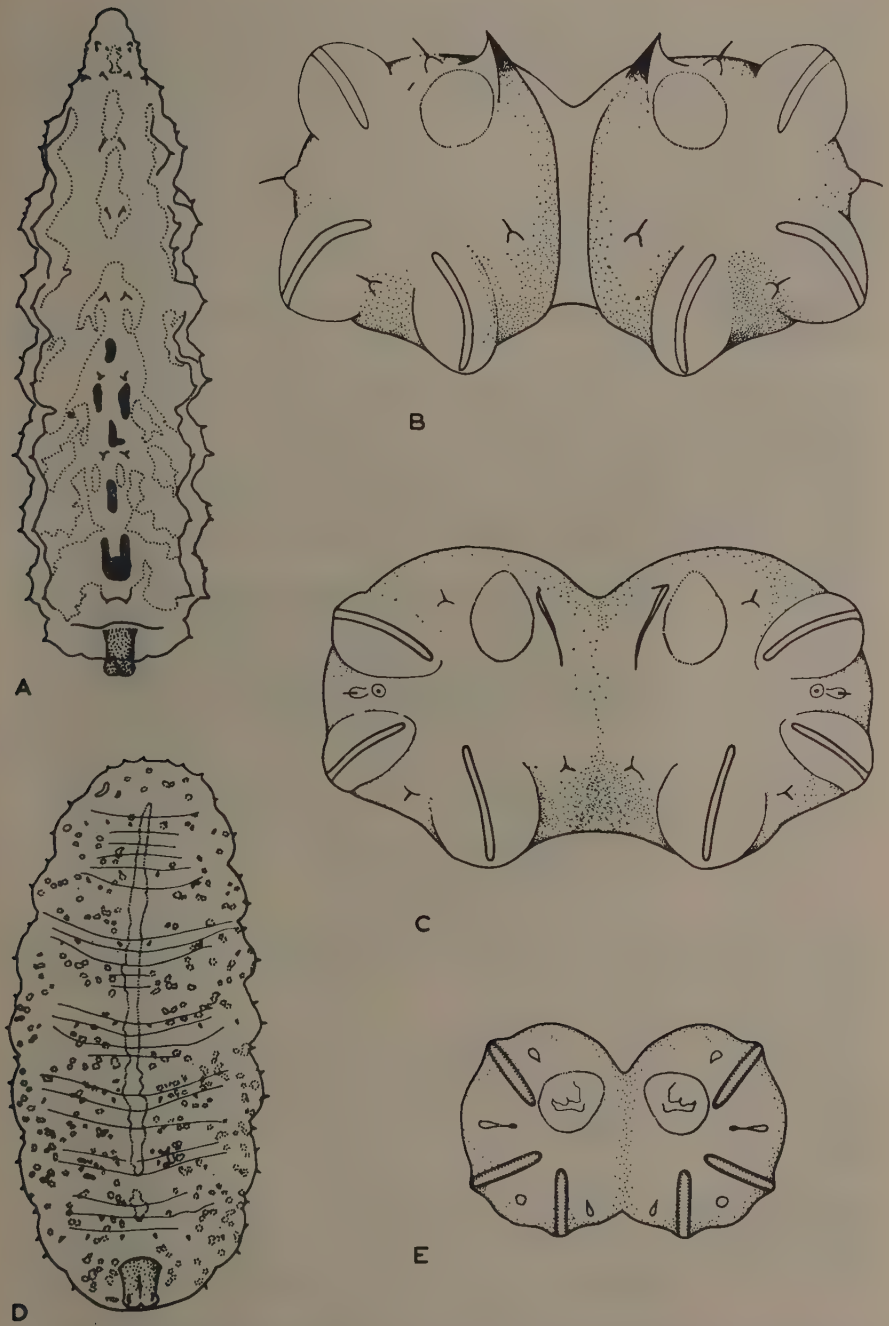

FIG. 6.—(*A*) *Syrphus triangulifer*, dorsal view of larva ; (*B*) *S. cinctus*, surface view of spiracular plates (after Heiss, 1938) ; (*C*) *S. triangulifer*, surface view of spiracular plates ; (*D*) *S. eligans*, dorsal view of larva ; (*E*) *S. balteatus*, surface view of spiracular plates.

36. *Syrphus grossulariae* Meigen
(previously undescribed)

Length 10 mm., width 2·25 mm., height 1·5 mm.; colour markings as in *S. vitripennis*; subcylindrical, tapering anteriorly, rounded from above posteriorly; fleshy projections absent; prolegs and claws absent; integumental vestiture absent; body papillose; segmental ornamentation typical.

Posterior respiratory process: as long as broad, constricted halfway along length, sides of basal half parallel, apical half rounded; smooth walled; median groove reaching constriction; spiracular plates sloping ventrolaterally; dorsal spurs large, obtuse; interspiracular ornamentation of four pairs of setae mounted on nodules; spiracles straight, equidistant, mounted on carinae, spiracles I and III diverging by less than 180°.

Source of material: Collected by Dr. A. F. G. Dixon from *Quercus* sp. at Rossdhu in August.

37. *Syrphus umbellatarum* (Fabricius)
(previously undescribed)

Length 10–11 mm., width 3 mm., height 2·5 mm.; yellowish-green turning uniform cream prior to pupation; subcylindrical, tapering anteriorly, cuspidate posteriorly; transverse wrinkles shallow; fleshy projections and prominences absent; ventral sole flat and transversely wrinkled; integumental vestiture absent; body papillose; segmental ornamentation of typical form, colourless, small, arranged in ten rows of hairs, 16; 18; 12; and two hairs on segments 3 and 5; 4; 7–11; and 12, respectively.

Posterior respiratory process: one and a half times as long as broad; entirely sclerotized along its length; basal three-quarters nodular; circular plates displaced anteriorly and towards median groove; dorsal spurs prominent, crescent-shaped in dorsal view and curving partly over circular plates; interspiracular ornamentation consisting of setae on well-marked, slightly elongate nodules slightly higher than spiracles and situated on edge of spiracular plates in surface view; spiracles straight, equidistant, and raised slightly on carinae; angle between I and III less than 180°.

Source of material: Collected from herbs at Silwood Park from May to July.

38. *Syrphus auricollis* Meigen
(previously undescribed)

Length 10–11 mm., width 2·5 mm., height 2·5 mm.; body transparent, colourless; adipose tissue appearing dorsally as a white mass; an orange line on either side connected by a transverse bar; subcylindrical, tapering anteriorly, and cuspidate posteriorly; fleshy projections and prominences absent; integumental vestiture absent; body finely papillose, shining; segmental ornamentation typical, microscopic.

Posterior respiratory process: mounted on a basal cylindrical fleshy process; as long as broad; constricted two-thirds along length from the base; smooth; rounded at apex; a deep wide median groove present; circular plates anterior, and towards borders of median groove; dorsal spurs represented by a ridge along inner borders of circular plates; interspiracular ornamentation of four pairs of dark elongate nodules; spiracles straight, mounted on black carinae; II nearer to III than to I.

Source of material: Collected from *Sarothamnus scoparius* at Silwood Park in May and June.

39. *Syrphus cinctellus* (Zetterstedt) (Figs. 7*A*, 7*B*)
(previously undescribed)

Length 12–14 mm., width 2·5 mm., height 2·5 mm.; buff pink with two undulating dorsal cream bands; tracheal trunks appearing dark grey posteriorly; dorsolateral ridges absent; fleshy projections and prominences absent; integumental vestiture absent; body papillose; minute inconspicuous segmental hairs present.

Posterior respiratory process: slightly broader than long (2 : 1·25), entirely sclerotized; smooth; with a thickened rim at base; posteriorly wall of tube half as long as anteriorly, respiratory plates lying postero-ventrally; circular plates anterior and oval; dorsal spurs short; spiracles straight; II and III closer than I and II.

Source of material: Larvae reared from eggs obtained from gravid females captured at Silwood Park from July to September.

40. *Syrphus balteatus* (Degeer) (Fig. 6*E*)

Length 10–11 mm., width 2·5 mm., height 2·5 mm.; adipose tissue white, distinctive superficial pattern of five groups of two consecutive transverse bars of adipose tissue present connecting a sometimes incomplete fine line of adipose tissue on either side of heart line; Malpighian tubules appearing orange through integument; subcylindrical, tapering anteriorly, cuspidate posteriorly; fleshy projections and prominences absent; integumental vestiture absent; body papillose; segmental ornamentation of fine cone-like pegs on slightly enlarged papillae.

Posterior respiratory process: three-fourths as long as broad; completely sclerotized, smooth; constricted one-third distance from the base; circular plates large and oval; dorsal spurs reduced to a small fold on inner borders of circular plates; interspiracular ornamentation of four pairs of inconspicuous nodules; spiracles equidistant, raised on carinae slightly above level of spiracular plates; III parallel to median groove, angle between I and III 135°; fringe of hairs present on inner border of spiracles.

Source of material: Collected from trees, shrubs and herbs at Silwood Park from June to September.

Previous descriptions: Vimmer (1925), Krüger (1926), Bhatia and Shaffi (1932), Scott (1939), Fielding (1953).

41. *Syrphus torvus* Osten-Sacken (Fig. 7*E*) (after Heiss (1938) and Metcalf (1916))

Length 10–13 mm., width 3–4 mm., height 2·5 mm.; brownish-pink with yellow chevrons; subcylindrical, tapering anteriorly and emarginate posteriorly; longitudinal keel present on each side; fleshy projections absent; integumental vestiture absent; body papillose.

Posterior respiratory process: about three quarters as long as broad; smooth and rounded at the apex; dorsal spurs almost midway along length of spiracular plates; circular plates oval; interspiracular nodules close around centre of spiracular plates and between inner ends of spiracles; spiracles straight, approximately equidistant, and situated on slight carinae; angle between I and III just less than 180°.

Previous descriptions: Smith (1890), Metcalf (1911, 1913, 1916), Fluke (1929), Sack (1929), Heiss (1938), Gäbler (1938).

42. *Syrphus ribesii* (L.) (Figs. 3*B*, 5*B*)

Length 9·0–11·5 mm., width 2·5 mm., height 2 mm.; from a fine cream line on either side of heart line five segmentally arranged postero-laterally directed oval groups of white to bright yellow adipose tissue; adipose tissue occasionally entirely pink in some specimens, gut contents appearing black beneath adipose tissue; subcylindrical, tapering anteriorly, cuspidate posteriorly; fleshy projections and prominences absent; integumental vestiture restricted to a few fine dark hairs round mouth; body papillose; segmental ornamentation typical.

Posterior respiratory process: half as long as broad; smooth; sclerotized; constricted one-third length from base; circular plates round; dorsal spurs prominent and broadly triangular in side view; interspiracular ornamentation consisting of four pairs of well-developed nodules; spiracles straight, equidistant, mounted on dark carinae; I and III slightly less than 180° apart; a fringe of hairs present on inner border of spiracles.

Source of material: Collected from trees, shrubs and herbs at Silwood Park from June to October.

Previous descriptions: Vimmer (1925), Krüger (1926), Fluke (1929), Bhatia (1939), Scott (1939: not distinguished from *S. vitripennis*), Fielding (1953).

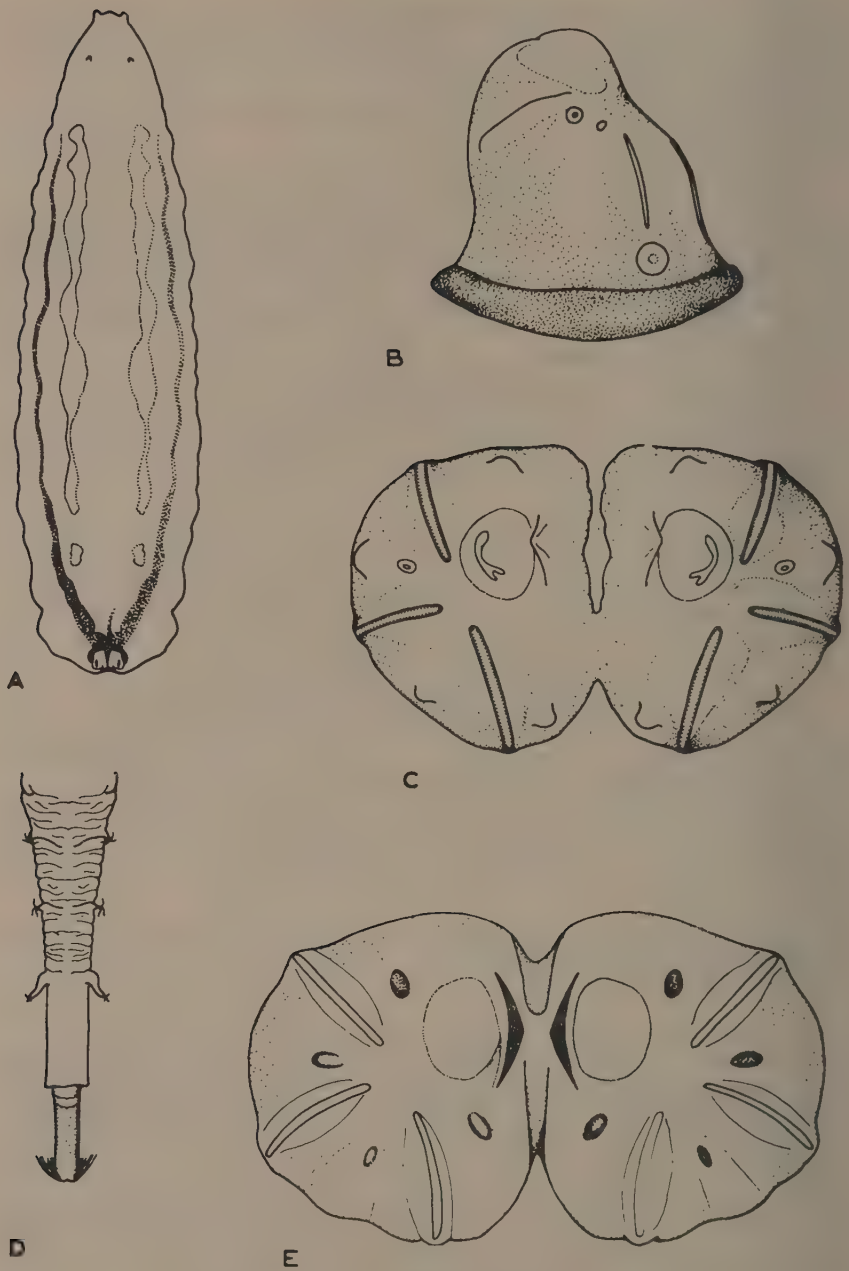

Fig. 7.—(*A*) *Syrphus cinctellus*, dorsal view of larva ; (*B*) the same, left side view of posterior respiratory process ; (*C*) *S. vitripennis*, surface view of spiracular plates ; (*D*) *Pocota personata*, dorsal view of post-anal region of body ; (*E*) *Syrphus torvus*, surface view of spiracular plates (after Heiss, 1938).

43. *Syrphus vitripennis* Meigen (Fig. 7*C*)

Length 10–13 mm., width 2·5 mm., height 2 mm.; arrangement of adipose tissue as in *S. ribesii*; postero-laterally directed ovals cream, tissue along either side of the heart line in forwardly directed V-shaped chains of deep orange tissue, medially ovals sometimes also orange or pink; gut contents appearing black beneath adipose tissue; body form and ornamentation as in *S. ribesii*.

Posterior respiratory process: form of respiratory process and characters of respiratory plate as in *S. ribesii*; posterior respiratory tube heavily sclerotized, but in *S. ribesii* pale.

Source of material: Collected from trees, shrubs and herbs at Silwood Park from May to October.

Previous descriptions: Scott (1939: not distinguished from *S. ribesii*), Fielding (1953).

44. *Chrysogaster hirtella* Loew (Fig. 8*E*) (partly after Varley (1937))

Length 7 mm.; dull grey, slightly transparent; ventrally flattened, tapering posteriorly; first four segments forming a false head; transversely wrinkled; posteriorly two pairs of lateral fleshy projections with long branched hairs; five pairs of prolegs present armed only with weak hairs; integumental vestiture of fine colourless hairs; segmental ornamentation of bifid hairs twice as long as hairs of integumental vestiture; external sclerotized mouth parts absent; filter-feeding.

Posterior respiratory process: terminal; telescopic, extensible in three segments to just over half length of body; distal needle-like process mounted on a wider cylindrical base; entirely sclerotized; circular plates and dorsal spurs absent; three pairs of sensillae consisting of a round peg 0·003 mm. across set in a small circle on basal half of needle; three pairs of longitudinal spiracles situated on distal tapering half of needle, one anterior and posterior pair present on dorsal surface, one pair present on ventral surface.

Previous descriptions: Varley (1937), Hartley (1958).

45. *Rhingia campestris* Meigen (Figs. 8*H*, 8*J*)

Length 10–12 mm., width 3 mm., height 3 mm.; subcylindrical, broadly tapering anteriorly and posteriorly; first four segments forming a false head with fourteen longitudinal furrows; anterior cornu on segment 3 in front of second furrow on either side of median line; spinules in longitudinal rectangular patches on segments 2–4; thereafter generally distributed; prolegs and fleshy processes absent; segmental spines strongly sclerotized, posterior ones much the longer with lateral spikes and stellate apices; twelve spines on segments 3 and 12; fourteen on segment 4; sixteen on segments 5–11; external sclerotized mouth parts absent; saprophagous in dung pats.

Posterior respiratory process: terminal; twice as long as broad; entirely sclerotized; circular plates large; dorsal spurs absent; interspiracular ornamentation of four tufts of palmately branched hairs on border of each spiracular plate; three pairs of confluent spiracles wide, dentate, and convoluted, not mounted on carinae; spiracles extending around circular plates and almost reaching the shallow median groove.

Source of material: British Museum (Natural History).

Previous descriptions: Krüger (1926), Coe (1942).

46. *Callicera rufa* Schummel (Fig. 8*A*)

Length 11 mm., width 3 mm., height 2·5 mm.; colourless, transparent; subcylindrical, truncate anteriorly, tapering posteriorly; first four segments forming a false head; a pair of separate thoracic prolegs, six pairs of closely approximated prolegs with three to five concentric rows of recurving spines; anterior cornua close together and behind first lateral furrow; a trifurcate appendage lateral to each cornu; integumental vestiture present; a patch of long straight spinules at anterior end of body; segmental ornamentation of long delicate pale hairs mounted on small papillae, posterior hairs the longest; six pairs of long anal gills present; external sclerotized mouth parts absent; filter-feeding.

Posterior respiratory process : terminal ; as long as broad ; entirely sclerotized ; constriction absent ; median groove between spiracular plates absent ; circular plates meeting in mid-line, a series of fine striae radiating from centre of each ; dorsal spines absent ; three pairs of straight transverse, parallel spiracles rather indistinct, and not mounted on carinae.

Source of material : British Museum (Natural History).
Previous descriptions : Coe (1938, 1939).

47. *Xylota sylvarum* (L.)
(previously undescribed)

Length 12 mm., width 4 mm., height 2–3 mm. ; dorsoventrally flattened, tapering and truncate anteriorly, and tapering posteriorly ; a false head present ; seven pairs of prolegs each with a group of recurved claws ; a pair of lateral fleshy projections at base of posterior respiratory process, two papillae anteriorly on the same segment, two papillae on penultimate segment, all equidistant and bearing long hairs ; integumental vestiture of microscopic setae ; segmental ornamentation minute ; external sclerotized mouth parts absent ; filter-feeding.

Posterior respiratory process : terminal ; entirely sclerotized ; nine times as long as broad ; spiracular plates not separated by a median groove ; circular plates round, with fine radiating striae ; dorsal spurs absent ; interspiracular ornamentation of four palmately branched appendages at periphery of each spiracular plate ; three pairs of convoluted, dentate spiracles surrounding circular plates, and not mounted on carinae.

Source of material : British Museum (Natural History).

48. *Pocota personata* (Harris) (Fig. 7*D*)

Length 25 mm., width 4 mm., height 4 mm. (1 specimen) ; whitish-yellow (Aubertin) ; posterior to segment 9 tapering and forming a post-anal region about 12 mm. in length ending in a telescopic respiratory process ; first four segments forming a distinct false head ; post-anal region with two pairs of lateral papillae and a postero-lateral pair of fleshy projections all ending in stellate groups of hairs ; one pair of thoracic and six pairs of abdominal, well separated, prolegs with concentric rows of claws ; integumental vestiture dense, of fine hairs, an anterior patch of dark upwardly curving spinules ; segmental ornamentation of twelve stellate groups of three or more hairs, the number increasing posteriorly ; external sclerotized mouth parts absent ; filter-feeding.

Posterior respiratory process : terminal ; about 2 mm. long ; smooth ; sclerotized ; lacking a constriction ; spiracular plates flat on one plane, and not separated by a median groove ; circular plates large, contiguous along median line ; dorsal spurs absent ; interspiracular ornamentation of four palmately branched plumose hairs arising from periphery of each spiracular plate ; three pairs of convoluted, dentate spiracles symmetrical on the two spiracular plates and surrounding central plates ; spiracles not mounted on carinae.

Source of material : British Museum (Natural History).
Previous description : Aubertin (1928).

49. *Syritta pipiens* (L.)

Length 10·5–12 mm., width 2–3 mm., height 2 mm. ; greyish or brownish-cream ; subcylindrical, bluntly rounded anteriorly, tapering gradually towards posterior respiratory process posteriorly ; first four segments forming a false head ; transversely wrinkled except on segment 3, segment 3 with longitudinal wrinkles ; three pairs of lateral equidistant posterior projections lying on the same plane, two pairs on segment 11, and one on segment 12 ; indistinct prolegs present bearing minute claws ; integumental vestiture of fine hairs, less distinct ventrally ; segmental hairs fine and similar to integumental hairs ; external sclerotized mouth parts absent ; filter-feeding.

Posterior respiratory process : terminal ; arising from a fleshy rim ; twice as long as broad ; narrowing after a constriction about two-thirds along length ; smooth, entirely sclerotized ; median depression between spiracular plates absent ; circular plates round, median, with fine

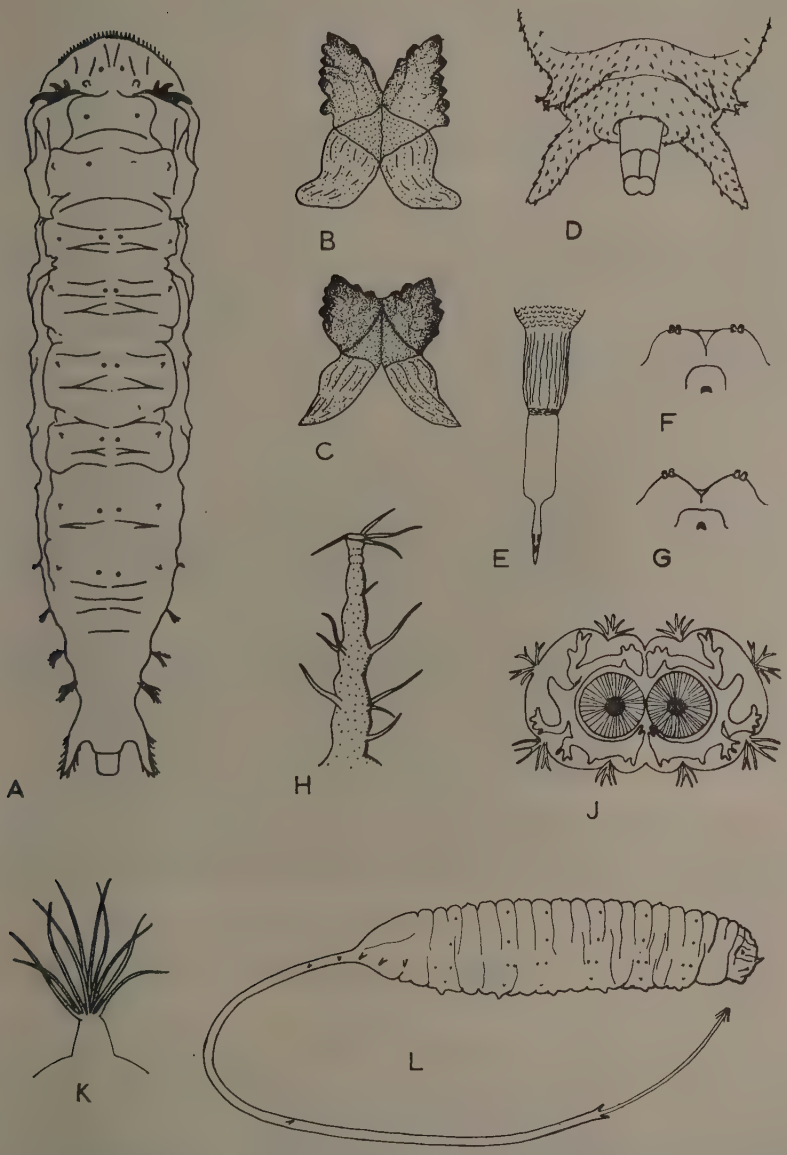

FIG. 8.—(*A*) *Callicera rufa*, dorsal view of larva; (*B*) *Eumerus strigatus*, mandibular sclerites (after Hodson, 1932); (*C*) *E. tuberculatus*, mandibular sclerites (after Hodson, 1932); (*D*) *E. strigatus*, dorsal view of posterior projections and tubercles; (*E*) *Chrysogaster hirtella*, posterior respiratory process; (*F*) *Eumerus strigatus*, antennal papillae (after Hodson, 1932); (*G*) *E. tuberculatus*, antennal papillae (after Hodson, 1932); (*H*) *Rhingia campestris*, segmental spine; (*J*) the same, surface view of spiracular plates; (*K*) *Mallota cimbiciformis*, segmental ornamentation; (*L*) the same, side view of larva.

radiating striae; dorsal spurs absent; interspiracular ornamentation of four fan-like tufts of stout plumose hairs at periphery of each spiracular plate; three pairs convoluted dentate spiracles with internal bars, not mounted on carinae, surrounding circular plates.

Source of material: Collected from semi-liquid rotten grass clippings at Silwood Park in July and August.

Previous descriptions: Beling (1882), Wandolleck (1898), Metcalf (1916), Krüger (1926), Hodson (1931), Johannsen (1935), Heiss (1938).

50. *Eumerus strigatus* (Fallén) (Figs. 8*B*, 8*D*, 8*F*)

Length 6–8 mm., width 3 mm., height 2·8 mm.; greyish or reddish-brown (Heiss, 1938); subcylindrical, slightly dorsoventrally flattened, equally tapering anteriorly and posteriorly; transversely wrinkled; dense integumental vestiture slightly longer on dorsal and ventral transverse ridges of the body; seven pairs of small round ventral prominences; segments 5–10 bearing two segmental spines on ventral prominences; claws absent; two large postero-laterally directed projections at base of posterior respiratory process on segment 12; two shorter dorsolaterally directed projections on segment 11, and two twin tubercles posterior and slightly ventral to these, each bearing segmental spines; segmental spines situated on large papillae in successive rows of 8, 6, 16, 16, 18, 18, 18, 18, 18, 18, 16, 12; anteriorly these papillae bear a bifid spine, posteriorly three or four spines; external mouth parts as in figure 8*B*; larva phytophagous in bulbs.

Posterior respiratory process: terminal; recessed in an oval fleshy rim; twice as long as broad; entirely sclerotized, smooth; tapering slightly beyond a constriction halfway along length; median groove between spiracular plates absent; circular plates large, sloping towards median line and with radiating striae; dorsal spurs and carinae absent; interspiracular ornamentation of four tufts of palmate hairs on rim of each spiracular plate; three pairs of convoluted, dentate spiracles surrounding circular plates.

Source of material: British Museum (Natural History).

Previous descriptions: Wilcox (1926), Essig (1926), Wilcox (1927), Vimmer (1931), Balachowsky and Mesnil (1936), Heiss (1938), Kanervo (1942).

51. *Eumerus tuberculatus* Rondani (Figs. 8*C*, 8*G*) (after Hodson, 1932)

Larva as in *E. strigatus* except anal processes unicolorous or only slightly darker than remaining integument rather than appreciably darker; integumental vestiture paler, more abundant; larger segmental spines paler, longer; mandibular sclerites and groove between antennae as in figures 8*C*, 8*G*; anterior spiracles paler.

Posterior respiratory process: as in *E. strigatus* except longer, narrower and paler.

Previous descriptions: Hodson (1927, 1931, 1932), Balachowsky and Mesnil (1936), Heiss (1938), Kanervo (1942).

52. *Helophilus pendulus* (L.)

Length 12–13 mm., width 3 mm., height 2·5 mm.; greyish transparent; subcylindrical; segments 1–4 forming a false head; body constricted posteriorly and ending in a long tail-like process; transversely wrinkled; a pair of thoracic prolegs lateral to mouth, six pairs of separate prolegs each with two parallel rows of claws; segmental ornamentation of flexible hairs; external mouth parts absent; filter-feeding.

Posterior respiratory process: terminal; at least twice length of body when fully extended; of three extensible segments as described for *Eristalis aeneus*; median groove between spiracular plates absent; circular plates round; dorsal spurs absent; interspiracular ornamentation of plumose hairs, four on rim of each spiracular plate; two semicircular openings present.

Source of material: Collected from rot holes in the trunks of *Fagus sylvatica* L. at Silwood Park from June to November.

Previous description: Klein-Krautheim (1936).

53. *Mallota cimbiciformis* (Fallén) (Figs. 8*K*, 8*L*)

Length 18–24 mm., width 5 mm., height 6 mm. ; subcylindrical, truncate anteriorly, rounded posteriorly ; false head present ; seven pairs of prolegs present, each with a group of poorly developed claws ; median groove widening from mouth to base of thoracic prolegs ; segmental ornamentation of tufts of four to twelve transparent hairs mounted on papillae ; external sclerotized mouth parts absent ; filter-feeding.

Posterior respiratory process : terminal ; almost twice length of body when fully extended, of three telescopic segments ; basal segment fleshy and transversely wrinkled with four pairs of lateral papillae, one distally, two medially, one proximally, all ending in a group of hairs ; middle segment fleshy with longitudinal striae ; distal segment smooth and sclerotized ; spiracular plates not separated by a median groove ; dorsal spurs absent ; circular plates circular ; interspiracular ornamentation of four wide, flattened, plumose hairs at rim of each spiracular plate ; semi-circular spiracular opening on each spiracular plate, not mounted on carinae.

Source of material : British Museum (Natural History).
Previous descriptions : Becher (1882), Lundbeck (1916), Johannsen (1935).

54. *Myiatropa florea* (L.)

Length 15–20 mm., width 5 mm., height 4·5 mm. ; subcylindrical, rounded posteriorly, tapering and truncate anteriorly ; false head present ; seven pairs of prolegs present, thoracic pair with groups of claws, six abdominal pairs with two rows of claws ; integumental vestiture of pale microscopic hairs ; anterior end of body with a patch of spinules, a conspicuous longitudinal row of hairs on either side of prolegs ; segmental ornamentation of inconspicuous hairs slightly longer than integumental hairs ; external sclerotized mouth parts absent ; filter-feeding ; twelve anal gills present.

Posterior respiratory process : terminal ; three times length of body when fully extended (Johannsen, 1935) ; in three telescopic segments, basal segment fleshy with transverse striae, middle segment fleshy with longitudinal striae, and terminal segment smooth and sclerotized ; circular plates round ; dorsal spurs absent ; interspiracular ornamentation of four pairs of long stout plumose hairs arising from rim of spiracular plates ; single pair of wide semi-circular spiracular openings not mounted on carinae.

Source of material : British Museum (Natural History).
Previous descriptions : Beling (1888), Sack (1921, 1931), Krüger (1926), Johannsen (1935).

55. *Eristalis aeneus* (Scopoli)

Length 13–15 mm., width 3–4 mm., height 2–3 mm. ; greyish or brownish ; subcylindrical, anteriorly roughly truncate, posteriorly constricted, ending in a long respiratory process ; seven pairs of prolegs present with recurved claws of various sizes ; integumental vestiture of dense, short flexible pale hairs ; a sparse patch of hairs on anterior extremity ; segmental ornamentation of paired flexible transparent hairs ; twelve anal gills present ; anterior cornua horn-like in shape ; spiracles with twenty rounded lobes ; external sclerotized mouth parts absent ; filter-feeding.

Posterior respiratory process : terminal, in three telescopic segments extensible at most to 100 mm. (Metcalf, 1913) ; basal segment fleshy. 0·5 mm. in diameter, transversely wrinkled, with hairs half as long as integumental hairs ; middle segment with longitudinal ridges bearing alternating rows of minute recurved pointed scale-like hairs half as long as integumental hairs ; terminal segment smooth, shining, extremely finely transversely ridged ; spiracular plates convex, not separated by a median groove ; interspiracular ornamentation of four pairs of plumose hairs from periphery of spiracular plates ; two semi-circular spiracles present.

Source of material : British Museum (Natural History).
Previous descriptions : Metcalf (1913), Johannsen (1935).

56. *Eristalis tenax* (L.)

Length 17–20 mm., width 4–5 mm., height 4–4·5 mm.; greyish, brownish or yellowish; body form as in *E. aeneus*; prolegs, integumental vestiture and segmental ornamentation as in *E. aeneus*; twenty anal gills present; external mouth parts absent; filter-feeding.

Posterior respiratory process: terminal, in three telescopic segments as in *E. aeneus*, fleshy middle segment more than one-third length of basal segment when respiratory process fully extended; spiracular plates not separated by a median groove; dorsal spurs absent; inter-spiracular ornamentation of four pairs of plumose hairs from periphery of each spiracular plate; two semi-circular spiracular openings present.

Source of material: Collected from rot holes in the trunks of *Fagus sylvatica* and *Tilia* x *vulgaris* Hayne at Silwood Park from June to October.

Previous descriptions: Batelli (1879), de Meijere (1895), Wahl (1900), Wandolleck (1898), Metcalf (1913), Vimmer (1925), Gäbler (1930, 1932), Johannsen (1935), Klein-Krautheim (1936), Smart (1948).

IV. Discussion

The classification of Syrphidae employed here is that given by Coe (1953). The habits and morphology of syrphid larvae so far described conform with this arrangement.

The subdivision by Goffe (1945) of the largest genus, *Syrphus* Fabricius, 1775 (*sensu* Coe), into nine genera provides only an approximate conception of the generic affinities shown by the morphology of the larvae. The larvae of the species listed by Goffe in the genera *Metasyrphus* Matsumura, 1917, and *Syrphella* Goffe, 1944, respectively, are closely related, as shown by the habits and morphology of the larvae of the species so far described. However, Goffe separates *Syrphus eligans* (Harris) and *S. nitidicollis* Meigen, which are almost identical in their larval habits and morphology and are both univoltine species, into the genera *Epistrophe* Walker, 1852, and *Syrphidis* Goffe, 1933, respectively. He segregates *Syrphus torvus*, *S. ribesii* and *S. vitripennis* which are polyvoltine and in which the larvae are alike in their morphology, together with *S. nitidicollis*, which is univoltine and the larva of which is quite distinct from the other three species, into the genus *Syrphidis*. *Syrphus grossulariae* and *S. eligans* also have larvae which are quite distinct, and Goffe places both species in the genus *Epistrophe* Walker, 1852. Therefore the species included by Goffe in at least *Epistrophe* and *Syrphidis* do not form natural groups when the larvae are taken into account. Further study of both syrphid eggs and larvae may elucidate affinities within groups and provide a basis for assessing the validity of genera.

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VI. Summary

A key is given to larvae of 56 of the 234 species of Syrphidae occurring in Britain. This is followed by detailed descriptions of these larvae, of which 15 species were hitherto undescribed; 35 are redescribed as existing accounts are incomplete.

The bearing of larval habits and morphology on the classification of Syrphidae is briefly discussed.

VII. References

Andries, M., 1912, Zur Systematik, Biologie und Entwicklung von *Microdon* Meigen. *Z. wiss. Zool.* **103**: 300–61, 3 pls., 23 figs.

Aubertin, D., 1928, The larva of *Pocota apiformis* Schrank. *Entomologist* **61**: 151–2, 1 pl.

Balachowsky, A. and Mesnil, L., 1936, *Les insectes nuisibles aux plantes cultivées.* **2**: 1141–921 + xi, 368 figs. Paris.

Batelli, A., 1879, Contribuzione all'Anatomia ed alla Fisiologia della larva dell *Eristalis tenax. Bull. Soc. ent. Ital.* **11**: 77–120, 5 pls.

Becher, E., 1882, Ueber die ersten Stände einiger Syrphiden und eine neue *Myiolepta* Art. *Wien. ent. Ztg.* **1**: 249–54.

Beling, Th., 1882, Beitrag zur Metamorphose zweiflügeliger Insekten aus den Familien Tabanidae, Leptidae, Asilidae, Empididae, Dolichopodidae und Syrphidae. *Arch. Naturgesch.* **48**: 186–240.

—— 1888, Beitrag zur Metamorphose einiger zweiflügeliger Insekten aus den Familien Tabanidae, Empidae und Syrphidae. *Verh. zool.-bot. Ges. Wien* **38**: 1–4.

Bhatia, M. L., 1939, Biology, morphology and anatomy of aphidophagous syrphid larvae. *Parasitology* **31**: 78–129, 75 figs.

—— and Shaffi, M., 1932, Life-histories of some Indian Syrphidae. *Indian J. agric. Sci.* **2**: 543–70, 8 pls.

Brauns, A., 1953, Beiträge zur Ökologie und wirtschaftlichen Bedeutung der aphidivorer Syrphidenarten (Diptera). *Beitr. Ent.* **3**: 278–303, 13 figs.

—— 1954, *Terricole Dipterenlarven.* 179 pp., 6 pls., 96 figs. Berlin.

Campbell, R. E. and Davidson, W. M., 1924, Notes on aphidophagous Syrphidae of Southern California. *Bull. S. Calif. Acad. Sci.* **23**: 3–9; 59–71, 5 pls.

Coe, R. L., 1938, Rediscovery of *Callicera yerburyi* Verrall (Diptera: Syrphidae); its breeding habits, with a description of the larva. *Entomologist* **71**: 97–102, 1 pl.

—— 1939, *Callicera yerburyi* Verrall (Diptera: Syrphidae), a synonym of *C. rufa* Schummel; further details of its life-history, with a description of the puparium. *Ibid.* **72**: 228–31.

—— 1942, *Rhingia campestris* Meigen (Dipt., Syrphidae): An account of its life-history and descriptions of the early stages. *Ent. mon. Mag.* **78**: 121–30, 13 figs.

—— 1953, *Handbooks for the identification of British insects. X* (1). *Diptera: Syrphidae.* 98 pp., 46 figs. London.

Doucette, C. F. *et al.*, 1942, Biology of the narcissus bulb fly in the Pacific Northwest. *Tech. Bull. U.S. Dep. Agric.* **809**, 63 pp., 28 figs.

Dunn, J. A., 1949, The parasites and predators of potato aphids. *Bull. ent. Res.* **40**: 97–122, 5 figs.

Essig, E. O., 1926, *Insects of Western North America.* ix + 1035 pp., 766 figs. New York.

Fielding, M., 1953, *The parasites and predators of aphids infesting cabbages.* [Unpublished thesis (Ph.D.), Liverpool University.]

Fluke, C. L., 1929, The known predacious and parasitic enemies of the pea aphid in North America. *Bull. Wis. agric. Exp. Sta.* **93**: 1–47, 6 pls., 2 figs.

Gäbler, H., 1930, Die postembryonale Entwicklung des Tracheensystems von *Eristalis tenax* L. *Z. morph. Ökol. Tiere* **19**: 427–92, 50 figs.

—— 1932, Beitrag zur Kenntnis der *Eristalis*-Larven (Dipt.). *Stettin. ent. Ztg.* **93**: 143–7, 5 pls., 6 figs.

—— 1938, Massenauftreten von Larven der Schwebfliegenart *Syrphus torvus* O.-S. *Forstwiss. Zbl.* **60**: 611–6.

Goffe, E. R., 1945, *Syrphidae* in Kloet, G. S. and Hincks, W. D., *Check list of British insects.* 483 pp. Stockport.

Hartley J. C., 1958, The root-piercing spiracles of the larva of *Chrysogaster hirtella* Loew (Diptera Syrphidae). *Proc. R. ent. Soc. Lond.* (A) **33** : 81–87.

Hecht, E., 1899, Notes biologiques et histologiques sur la larve d'un Diptère (*Microdon mutabilis* L.). *Arch. Zool. exp. gén.* **7** : 363–82, 1 pl.

Heeger, E., 1858, Neue Metamorphosen einiger Dipteren. *S.B. Akad. Wiss. Wien* (1) **31** : 295–309, 4 pls.

Heiss, E. M., 1938, A classification of the larvae and puparia of the Syrphidae of Illinois exclusive of aquatic forms. *Illinois biol. Monogr.* **36** : 1–142, 17 pls.

Hennig, W., 1952, *Die Larvenformen der Dipteren.* **3.** vii + 628 pp., 21 pls., 338 figs.

Hodson, W. E. H., 1927, The bionomics of the lesser bulb flies, *Eumerus strigatus* Fln., and *Eumerus tuberculatus* Rond., in South-West England. *Bull. ent. Res.* **17** : 373–84, 2 pls.

—— 1931, A comparison of the immature stages of *Eumerus tuberculatus* Rond. and *Syritta pipiens* Linn. (Syrphidae). *Ibid.* **22** : 55–58, 3 figs.

—— 1932, A comparison of the larvae of *Eumerus strigatus* Fln. and *Eumerus tuberculatus* Rond. *Ibid.* **23** : 247–9, 2 figs.

—— 1932*a*, The large narcissus fly, *Merodon equestris* Fab. (Syrphidae). *Ibid.* **23** : 429–48, 1 pl., 1 fig.

Johannsen, O. A., 1935, Aquatic Diptera Part II. Orthorrhapha-Brachycera and Cyclorrhapha. *Mem. Cornell agric. Exp. Sta.* **177** : 1–62, 12 pls.

Jones, C. R., 1922, A contribution to our knowledge of the Syrphidae of Colorado. *Colo. agric. Bull.* **269**. 72 pp., 5 pls.

Kanervo, V., 1942, Die Unterscheidung der Larven und Puppen von *Eumerus tuberculatus* Rond. und *E. strigatus* Fall. (Dipt., Syrphidae). *Ann. ent. fenn.* **8** : 227–33.

Klein-Krautheim, F., 1936, Beitrag zur Kenntnis der Eristalinen-Larven und -Puppen (Syrphidae, Diptera). *Stettin. ent. Ztg.* **97** : 259–70, 1 pl., 2 figs.

Krüger, F., 1926, Biologie und Morphologie einiger Syrphidenlarven. *Z. Morph. Ökol. Tiere* **6** : 83–149, 26 figs.

Künckel d'Herculais, J., 1875, *Récherches sur l'organization et le développement des Volucelles, Insectes Diptères de la famille des Syrphides.* Part 1. iv + 208 pp. 11 pls. Paris.

Lundbeck, W., 1916. *Diptera Danica* **5** (*Lonchopteridae, Syrphidae*). 591 pp., 202 figs. Copenhagen.

Meijere, J. C. H. de, 1895, Ueber zusammengesetzte Stigmen bei Dipteren-larven, nebst einem Beitrag zur Metamorphose von *Hydromyza livens*. *Tijdschr. Ent.* **38**: 65–100, 1 fig.

—— 1916, Beiträge zur Kenntnis der Dipteren-Larven und -Puppen. *Zool. Jb.* (Abt. 1) **40** : 177–322, 14 pls.

Metcalf, C. L., 1911, A preliminary report on the life histories of two species of Syrphidae. *Ohio Nat.* **11** : 337–44, 2 pls.

—— 1911*a*, Life-histories of Syrphidae 2. *Ibid.* **11** : 397–404, 1 pl.

—— 1913, Life-histories of Syrphidae 5. *Ibid.* **13** : 81–91, 2 pls.

—— 1913*a*, The Syrphidae of Ohio. *Bull. Ohio Univ.* **1** : 1–124, 11 pls., 2 figs.

—— 1916, Syrphidae of Maine. *Bull. Me. agric. Exp. Stn.* **253** : 193–264, 9 pls.

—— 1917, Syrphidae of Maine—Second report: Life history studies. *Ibid.* **263** : 153–76, 5 pls.

Parmenter, L., 1954, A list of the species of Syrphidae (Diptera) of the British Isles. *Ent. Gaz.* **5** : 135–44.

Poujade, G. A., 1883, Métamorphoses d'un Diptère de la famille des Syrphides. *Ann. Soc. ent. Fr.* **3** : 23–30.

Sack, P., 1921, Beitrag zur Entwicklung einiger Syrphiden (Dipt.). *Senckenbergiana* **3** : 158–63, 5 figs.

—— 1928–32, *Syrphidae* in Lindner, E., *Flieg. Palaearkt. Reg.* **4** (4), no. 31, 451 pp., 4 pls., 48 figs. Stuttgart.

—— 1931, Syrphidae (Diptera) der deutschen limnologischen Sunda-Expedition. *Arch. Hydrobiol.*, Suppl. **8** : 585–92, 8 figs.

Scott, E. I., 1939, An account of the developmental stages of some aphidophagous Syrphidae (Dipt.) and their parasites (Hymenopt.). *Ann. appl. Biol.* **26** : 509–32, 6 pls.

SMART, J., 1948, *A handbook for the identification of insects of medical importance.* Ed. 2. 272 pp., 13 pls., 178 figs. London.

SMITH, J. B., 1890, Plant lice and how to deal with them. *Bull. N. J. Coll. Agric.* **72** : 11–15.

VARLEY, G. C., 1937, Aquatic insect larvae which obtain oxygen from the roots of plants. *Proc. R. ent. Soc. Lond.* (A) **12** : 55–60, 2 figs.

VIMMER, A., 1925, *Larvy a kukly dvojkridleho hmyzu stredoevropskeho se zylastnim zretelem na skudce rostlin kulturnich.* Prague.

—— 1931, Ueber die Larven kleiner Fliegen, welche in der Tschechoslovak. Rep. durch Ausnagen von Hyponomen den Pflanzen schaden. *Arch. přírodov. Výzk. Čech.* **18** : 1–59, 22 pls.

—— 1933, Larvy a pupy českých pestrenek (Syrph. Dipt.). *Acta. Soc. ent. Bohem.* (*Čsl.*) **30** : 181–7, 39 figs.

VINE, H. C. A., 1895, Predacious and parasitic enemies of the aphides (including a study of hyper-parasites). *Int. J. Micr.* **5** : 33–42, 2 pls.

WAHL, B., 1900, Ueber das Tracheensystem und die Imaginalscheiben der Larve von *Eristalis tenax* L. *Arb. zool. Inst. Wien* **12** : 1–54, 2 figs.

WANDOLLECK, B., 1898, Die Fühler der cyclorrhaphen Dipterenlarven. *Zool. Anz.* **21** : 283–94, 8 figs.

WILCOX, J., 1926, The lesser bulb fly, *Eumerus strigatus* Fallén, in Oregon. *J. econ. Ent.* **19** : 762–72, 1 pl., 4 figs.

—— 1927, Observations on the life history, habits and control of the narcissus bulb fly *Merodon equestris* Fabr. and the lesser bulb fly *Eumerus strigatus* Fallén in Oregon. *Bienn. Rep. Ore. Bd. Hort.* **19** : 149–58, 10 figs.